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The Veterinary Journal.

MARCH, 1934.

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The Bacon Pig.
By The Earl of Radnor, late Chairman of the Pig Industry Council, Member of the Pig Marketing Board.
(With *Plate* showing Ideal Bacon Pig and Champion Large White Sow.)

THE
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MARCH, 1934.

Editorial

PIGS AND THEIR SCIENTIFIC STUDY.

THE idea of devoting a whole number of THE VETERINARY JOURNAL entirely to the scientific study of the pig would at one time, not so long ago, have been ridiculed; but a glance at the titles of the articles appearing in this month's issue will convince even the most cynical critic that even a pig can fill a useful place in assisting very materially the welfare of the nation.

Epidemics, if not able to be properly controlled, are just as serious and insidious in their consequences amongst pigs as amongst any other of the farm animals, and in many cases even more so, as the pig is often the sole arbiter whose fate decides for the small capitalist the question as to whether he shall have just that little amount of extra income which means comfort instead of struggling penury. The men who can assist the most in this object of helping the pig owner are the scientific research workers and the practising or inspecting veterinary surgeons.

In the daily routine of feeding and general management the details of hygiene and rational dietary are as essential with the pig as with those of the other domesticated animals; and it is with the object of dilating upon each and all of these things that these contributions are laid before our readers.

As in the case of the Special Canine Number a prominent member of a Sporting Canine Society kindly consented to write the Supplement, so on this occasion a prominent and enthusiastic member of the new *régime* under the control of the Pigs Marketing Board has consented to write the Supplement, and has chosen as the subject " The Bacon Pig."

Our Universities do not consider the pig beneath their notice, and the Veterinary and Agricultural Colleges all take a hand in the game. The recent pronouncements of the Rt. Hon. Walter Elliot, the Minister of Agriculture, and the personal efforts of the Ministry officials themselves, all tend to show that the country is at last awakening not only to the fact that there is a demand for home products, but also that there is a necessity for protecting them from the ever-increasing encroachments of our foreign competitors. From our own veterinary point of view we must be ready to find the supply when the demand comes—especially on the preventive medicine side—and for this the profession can find the brains if only those who are to receive the benefit of their work will find the means.

THE "SCRUB" BOAR.

NOTHING leaves its taint behind so much as a procreative male with hereditary defects, and now that the Ministry of Agriculture and Fisheries has effectively disposed of the "scrub" stallion, and the "scrub" bull meets its doom on August 1st next, it is to be hoped that before another year has passed the "scrub" boar will have been made to follow suit. That it *will* come at some future date can be prophesied with certainty, for—in the pig just as much as in the case of the stallion and the bull—not only does the necessity arise, but the beneficial effects on the marketing value of pigs and their progeny will be immeasurably increased. It is almost impossible to find a breeder of pigs who does not recognise the prevalence of hernia amongst certain strains, and cryptorchidism is seen here more frequently than in any other species of farm animal. Both are very hereditary, as are also many defects of conformation and constitutional weakness, more, perhaps, in proportion in the pig than in most other animals, on account of the large number of young ones at each birth. Such things cause much unnecessary loss; and by seeking veterinary advice on such eugenic questions the breeder can be told with certainty how to prevent their occurrence. In eugenic breeding the veterinarian has many advantages over his medical *confrères*, as the stud animals (except perhaps such night wanderers as cats) are usually under strict control. The commercial sequel, which is not considered from the same standpoint in humans, does at any rate play its part to advantage when considering the eugenic standpoint of the patients of the veterinary surgeon. It is a matter for future Government consideration, and, if passed, will speedily do as much for the eugenic side of pig breeding as the Improvement of Livestock (Licensing of Bulls) Act will do for the improvement of the race of the British cattle. Parliamentary measures of this kind will always receive the hearty support and collaboration of the members of the veterinary profession, and Mr. Elliot is to be congratulated on the firm start which he has made in this direction.

General Articles

PEDIGREE PIGS AND THE PIG SCHEME.

By ALEC HOBSON

Secretary, National Pig Breeders' Association.

THE National Pig Breeders' Association celebrates its Jubilee this year. It is fitting that this important event in the history of the largest of our pig breed societies should synchronise with the expansion of pig breeding on an unprecedented scale; indeed, the pig bids fair to become one of the country's most valuable domestic animals. Fifty years of continuous work to improve breed standards is thus crowned so effectively and appropriately that the founders of the Association should have no doubts as to the soundness of their pioneer work. Had this great work of pedigree recording and the raising of standards not been taken in hand, it is almost certain that the Pig Scheme could not have been launched.

What was the position of pig breeding in relation to agriculture generally before the National Pig Breeders' Association was formed? In the early eighties of last century the breeds most generally recognised were the Berkshire, Large, Middle and Small Whites or Yorkshires, and the Small Black breed. It was intended that the pedigrees of the pure-bred pigs of all these breeds should be recorded by the Association, and published in one herd book. But it was not to be: the breeders of Berkshires decided to have a separate herd book; they started the British Berkshire Society—so named to distinguish it from the American Berkshire Record. Subsequently the Tamworth breed became recognised by the Royal Agricultural Society, and the breeders of the red pig joined the N.P.B.A. Then the demand for Small White and Small Black pigs ceased, so that eventually the pedigrees of Large White, Middle White and Tamworth pigs only were registered in the Association's Herd Book. As time progressed other herd-book societies were founded, notably the Large Black, Large White Ulster, the Lincolnshire Curly Coat, the Gloucester Old Spots, the Cumberland the Wessex Saddleback and the Essex. Since the War the Berkshire breed has returned to the fold of the N.P.B.A., and a fifth breed, the Wessex Saddleback, decided to amalgamate. Of the vicissitudes of the several other breed societies mentioned it would be possible to write at length; for the present, however, it will suffice to regard the N.P.B.A. as representative of breed societies in considering this question of what the Pig Scheme owes to pedigree stock.

Within the memory of a few breeders alive to-day the classification of pigs at our principal shows was of a very simple character; it consisted of classes for pigs of a white colour and for pigs of any other colour. There was no attempt

at any definition as to size, form, and quality of the pigs. These points were left to the judges, who not unnaturally were led to favour pigs of the type which they bred. The need of a more particular definition, if only of colour, quickly became obvious. At first classes were established for pigs of certain colours; then the prizes were offered to pigs of certain breeds which were more or less roughly defined. Now, at the Royal Agricultural Society's and other principal shows, pigs exhibited as pure bred must have qualified for entry in the herd books of their particular breeds. At the R.A.S.E. Show to be held at Ipswich this year, separate sections are provided for eleven breeds, and upwards of £1,600 cash will be offered as class prize money, apart from championship prizes, medals and other awards offered by the breed societies. This will indicate how pedigree pig breeding has developed and how widespread are its supporters.

The prosperity of the pedigree breeder is dependent on the prosperity of the commercial pig feeder. But a moment's reflection suggests that remunerative production of market stock is impracticable without the good foundation stock provided by the pedigree breeder. There exists a circle which must not be severed if progress and profit are to be achieved.

Mention has been made of the types of pig extant some fifty years ago. It is also worth while to consider the wide difference between the conformation, quality and character of our pigs before and since herd-book registration commenced. Thanks to the educational work of the breed societies the pig has now come to be regarded as a machine for the conversion of farm produce into meat, whereas in bygone years the pig was usually regarded as a scavenger or an animal to put out of sight certain articles containing a small amount of nutriment which, undisposed of, would become a nuisance. Sanders Spencer often recounted that in the " good old times " the one thing needful in pig fattening was a good supply of barley meal, as much of this as the pig could possibly eat being placed into its trough each day until the pig was thought to be fat enough for slaughter. This was a very simple and at the same time a costly process, and was looked upon as the second of the two chief acts in the life of a pig. The first consisted of building up a frame on which fat could be stored, a system of first growing the frame, and then packing it with flesh which was not confined to pigs. One of the excuses for the long store period was that the stock required age before it was possible to render it sufficiently fat for slaughter. How this viewpoint has changed, until to-day the pig is slaughtered for pork when little more than a weaner, and for bacon when only half grown, is understood by none more than the older members of our breed societies. The development of the agricultural show, with its classes for pigs of specified ages, had much the same result on maturity as have fat-stock shows, until size for age became such an important feature in exhibition work that at one time boars and sows approximating to the 8–10 cwt. were quite common. Meanwhile the real work of the breed societies was going on quietly and effectively; the average standard of herds was steadily raised, and this country became famous for its pedigree pigs; Denmark and other countries that decided

to engage in pig production on a large scale came here for boars and gilts. How effectively they used this foundation stock to improve and cross with their native breeds is well known.

The future development of our pig-breed societies is perhaps a more difficult problem than some would think. Registration of pedigrees has become but a section of their work. Members owning extensive herds of valuable stock lean more and more on the societies, not only to keep records and so enable a free interchange of breeding stock, but to help in its sale, and even, in some cases, to actually sell it. Where this will lead to is hard to predict. What is certain is that methods of the past may not prove adequate to the demands of a national industry. Pig recording, litter testing and the like have come to stay. How far they will aid in selection and mating can only be proved by experience.

When the Milk Marketing Scheme followed the Pig Scheme, and the disposal of surplus milk forced its way to prominence, the possibility of linking up the two schemes occurred to many thinking agriculturists. Milk is an ideal food for pigs. The real success of Scandinavian pig production is the effective dovetailing of their various farming activities: nothing is wasted; everything is used to the full advantage; even the bacon-curing establishments belong to the producer. Our two great schemes of planned production are as yet in their infancy; but sufficient experience has been gained to suggest that the old haphazard methods of production and marketing can never be allowed to return. Pedigree pigs will be wanted in increasing numbers. Already most farmers appreciate what has been termed "a bit o' blood," and with the growing realisation that pedigree breeding is so definitely a commercial enterprise, the demand for good stock seems certain to increase. Producers are out to secure a uniform standard in their herds. To do this pure-bred foundation stock is virtually essential. Cross breeding has its merits, of course; but even successful cross-breeding, which is so different from indiscriminate breeding, must rely on the pure-bred sire and straight-bred sows.

Pedigree breeders realise their responsibilities. They have a love for the job or they would not be engaged in it. Give them credit for this. Whatever objections may have been advanced against "these fancy pedigree pigs" in the past, the fact remains (it is worth repeating) that the Pig Scheme could hardly have started, cannot be carried on, and has no future without them. The National Pig Breeders' Association and other breed societies have done sterling work in national interests. There have been times when they have had but little encouragement, but they carried on. Far be it from me to suggest that they are justified in resting on their achievements; on the contrary, I venture to predict that the greatest work of these societies lies ahead, for the selection of foundation stock is likely to depend on more features than external conformation. Breed societies seek to make practical use of the laws of heredity. This means the creation of ideals and the revision of those ideals as tastes change. I have not the slightest doubt that the pedigree breeder will continue to be equal to the occasion.

XUM

PROBLEMS OF FEEDING AND MANAGEMENT IN PIG PRODUCTION.

By JOHN HAMMOND.

School of Agriculture, Cambridge.

If the hopes of the Pigs Marketing Scheme are realised, we may expect to find shortly a greatly increased interest taken in the welfare of the pig on farms throughout the whole country. The state of pig management and feeding to-day is very similar to that of dairy cow feeding and management twenty years ago, before milk recording societies were organised[1] and supplied the knowledge required for intensive production. After an experimental period, pig recording societies are now being started, and it is the purpose of this paper to deal briefly with some of the problems in pig feeding and management which have been brought to light by their activities. Many of the problems are only just beginning to be defined, but it is hoped that a statement of the case now may induce those who are in a position to do so to take a hand in their solution.

Pig recording aims at obtaining a measure of three main things:

(1) *The number and weight of the pigs in the litter at weaning time* (*eight weeks old*), *i.e.*, a measure of the fertility and mothering qualities of the sow, and the effects of feeding and management on the production of weaner pigs.

(2) *The number of days it takes the pig to reach bacon weight* (200 lb. *live weight*), *i.e.*, the rate at which it grows. Since the quicker it reaches this weight, the less it will consume in maintenance food requirements, the pig which grows quickest does so, on the average, most economically.

(3) *The quality of the carcase on slaughter, i.e.*, the factory grade attained by the carcase, together with a record of its " faults " from the point of view of the consumer's requirements.

In the same way that " cow wastage " studies in milk recording societies have disclosed some of the main causes of losses among dairy cattle, so the results of experimental pig recording societies, both in this country[2] and in New Zealand,[3] have shown that the co-operation of veterinary assistance is required in increasing the efficiency of production. For example, in the first year's working of the East Anglian Pig Recording Society[2] it was found that 20 per cent. of the pigs which were born alive died before they were eight weeks old. That this can be put right is shown by the fact that there are great differences between one herd and another in this respect: in the best herd, eleven pigs per litter were weaned, whereas in some other herds only six were weaned on the average, although ten were born alive. The Waikato Pig Recording Club's[3] figures show also that on the average for all sows, 9.6 pigs are born, but only 7.3 are alive at eight weeks old, this being a loss of 24 per cent. between birth and weaning.

The majority of these losses occur during the first week after birth. It seems probable, therefore, that we shall have to examine the conditions which

affect uterine nutrition and which lead to the production of weak pigs at birth, and to the conditions which affect the maternal instincts and milk supply of the sow—subjects about which there is much need for further scientific investigation.

An analysis of the figures also shows that the losses are greater during the winter months of the year: in East Anglia, 8.3 on the average are reared from 9.8 born during the months April to September, whereas only 7.3 on the average are reared from 9.9 born in the months of October to March. In New Zealand, too, the loss is 27 per cent. during their winter months, as compared with 22 per cent. during the summer months. It would seem likely that two different factors are concerned according to the circumstances under which the pregnant sows are kept. For a sow which is normally run outside, the provision of a clean, warm, and dry farrowing pen for about a fortnight before farrowing, so that she can get accustomed to it, will remedy much of the trouble; during this time she should be fed on milk-producing foods (as in the "steaming up" of dairy cows) in order to encourage growth of the mammary glands, and to nourish the embryonic pigs at a time when they are developing rapidly. When, however, the brood sows are kept housed throughout the whole length of pregnancy, then losses are also liable to occur for another reason. Under these latter conditions deficiencies in accessory food substances are liable to cause trouble, unless the sow is provided with those things which she would otherwise pick up from the grass or earth when running outside. In litters from sows housed all the time under these conditions many young pigs are liable to die of anæmia. Normally, the embryo stores in its liver a supply of iron, derived from the breakdown of maternal blood corpuscles, in order to supply its requirements during the suckling period, since milk is almost lacking in the iron so necessary for the formation of blood. Although few experiments have yet been done, it would seem reasonable to assume that where the mother has been kept inside throughout pregnancy, and is deprived of the opportunity to obtain iron from the soil, or greenstuff, she will not hand on to the embryonic pigs a supply sufficient for their requirements. The dosing of young pigs with iron salts is a troublesome proceeding, since they do not begin to eat until they are three to four weeks old, and, although it can be done with very good results, it would seem that the proper feeding and management of the pregnant sow affords the easiest means of attacking the problem. Where, for any reason, the pregnant sow must be kept indoors, the feeding of green stuff or ferric oxide with the meals would supply the iron necessary.

The next problem—that of the weight of the pig at weaning time—is an important one, for, as they say in New Zealand, "a pig well weaned is a pig half grown," and it is far less likely to become a sickly and unthrifty animal than one which is under weight at this time. In this respect also there is great variation between one herd and another, owing to differences in management: for example, in the first year's working of the East Anglian Society the best herd averaged a weight of 39.5 lb. per pig, and the worst only 20.8 lb. per pig at eight weeks old.

Again, if the weather is mild and the soil is dry, running the sow and litter on good grass or an old lucerne or seeds ley (which is fresh and not " pig-stained ") will enable them to pick up the necessary accessory food substances required for good growth. The practice of " creep feeding," too, is one which is most useful in getting the pigs to make a good start, for if they have been reared in this way they not only grow faster, but also feel the effects of weaning less, and continue their growth without check.

Good growth just before and after weaning time is important also from another point of view. As the pig grows up its proportions change ; at birth it is all head and legs and short in the body, with a high proportion of bone and low proportion of muscle. As it grows up, the body first lengthens in proportion, and then afterwards deepens and thickens ; with growth in length comes muscle development, and with depth and thickness of body comes fat development.[4] At and after weaning the body length and the muscles are developing rapidly, and since in the bacon pig great development of lean meat with only a minimum of fat is required, rapid growth at the time of life when the muscle is developing is an important factor in producing a carcase which will grade well at the factory.

Many pig carcases are now coming in to the factories with a poor development of the muscles, and with fatty tissue occupying the space which should have been filled by muscular tissue. For example, Figs. 1 and 2 show photographs of two adjoining bacon carcases at the last Smithfield Show ; these are cut through at the level of the last rib, and expose the outline of the longissimus dorsi muscle —the " eye " of the loin, and the most valuable part of the pig.[5] In Fig. 1 the muscle is rounded and thick, being covered by just the right proportions of fat to suit the consumer's taste. In Fig. 2, however, the longissimus dorsi muscle is flattened, and the rounded space which it should have occupied is filled in with fat instead ; what should have been the outline of the muscle can still be seen as a line of fibrous connective tissue between the subcutaneous fatty layer and the layer of fat which has replaced the muscular tissue. The existence of this line of demarcation seems to indicate that the capabilities for muscular development were there, but that they were not expressed owing to deficiencies in feeding or management. Since the measurements of the thickness of this muscle have always been good where a large weaning weight has been attained, it seems probable that, as suggested above, this is the critical time for the development of thick muscles, and that attention should be paid to the correct methods of feeding just before and after weaning so that the young pigs never lose their " baby flesh." This suggests that, instead of the old system of a store period after weaning followed by a period of rapid fattening towards the end of the feeding period, we might rather, for the production of first-class lean bacon, grow the pigs quickly in the early stages when the muscles are developing, and finish them more slowly later when the fat is developing. That is, we shou grow our pigs well rather than fatten them well.

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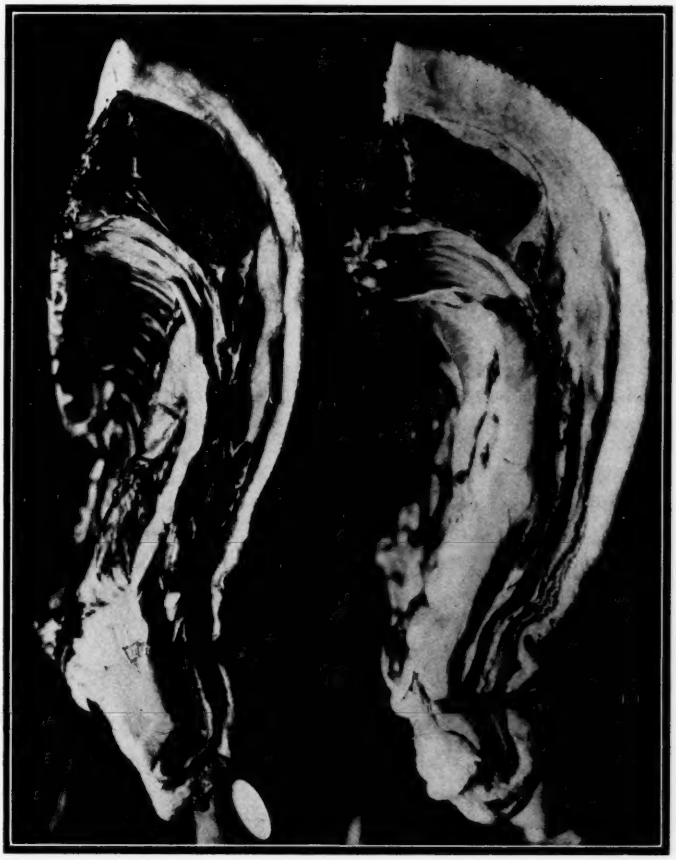

FIG. 1.—A carcase in which the muscle is well developed. It is thickened and covered with just the right amount of fat.

FIG. 2.—A carcase in which the capabilities for muscular development have not been realized. The muscle is flattened and the space which it should have occupied is filled with a deposit of fat, making the side much too thick in fat for the consumer's requirements.

Bacon sides, cut through at the last rib, showing differences in the development of the latissimus dorsi muscle ("eye" muscle).

(*Article by* John Hammond, *page* 98)

XUM

As to whether exercise is necessary to develop thick muscular tissue, there is, on the one hand, popular opinion, which is very much in favour of it, and, on the other, the fact that long-distance runners do not develop thick calf muscles. Experimental evidence is still required on this point. The fact that exercise leads to a lean carcase may be explained by other means. Exercise expends energy, and so reduces the fat put on, and hence increases the proportion of muscle to fat, but this is not the same thing as increasing the actual amount of muscle. Pigs which get plenty of exercise also usually obtain the facilities for picking up the additional accessory food substances, such as young grass and minerals, which are necessary for the formation of muscle. It may be that what is attributed to exercise is in reality due mainly to these factors.

This brings us to the next problem, that of the feeding and management required to produce muscular tissue rather than fat in our pigs. Most will agree that in order to produce muscular tissue a high ratio of protein is required in the ration, and that this can best be done by the use of the animal proteins, such as skim milk, meat-meal and fish-meal, although because of the taints that the last is liable to cause, its use is best limited to a few weeks before and after weaning time. The cheaper vegetable proteins, such as extracted soya bean meal, grain, and peameal, can also be used with almost as good results if a mineral mixture (at the rate of about 1 lb. to 1 cwt. of meal) is supplied with them. The mineral mixture usually recommended consists of salt 20 lb., ground limestone 40 lb., sterilised bone meal, 40 lb., and ferric oxide 5 lb. The reason why minerals make the vegetable proteins more efficient is, in my opinion, not one of digestion, but of building up of body proteins from the digested material. Many essential body proteins, such as the globulins (in which fraction of the serum the anti-bodies are found), are only soluble in dilute salt solution, and lack of salt causes their flocculation, and so puts them out of action. For this reason the provision of salt assists in the resistance to disease and the recovery from the lassitude experienced after profuse sweating, for in this process a large loss of salt to the body occurs. While the animal protein and living plant protein, such as that in young grass and lucerne, will contain sufficient salts to build up animal protein in the body, the storage proteins of seeds are lacking in salts. When the young bean seed starts to grow it draws up these salts from the soil, and by the addition of them converts the storage protein into the living protoplasm of the plant; so when we require to make the proteins of seeds available for the animal we must add these minerals, otherwise the proteins digested are not capable of being built up into muscular and body tissues. Whatever may be the theoretical explanation, however, it is an undoubted fact that the addition of minerals to a ration of cereal meals and vegetable proteins increases the rate of growth, and decreases the number of pounds of meal required to produce one pound of pig from about six pounds of meal to just under four pounds; or, as measured by pig recording societies, it decreases the number of days which it takes a pig to reach bacon weight. No reference has been made above to the influence of hereditary factors

in relation to feeding and management, although it is very evident that they exist. Pig recording, just as milk recording, offers great possibilities for improvements in this direction, not only by direct selection for the qualities required through progeny tests, but also by improving the environment in which the selection is made; for frequently under present conditions the true genetic qualities of the animal get no chance of expressing themselves owing to defects in the environment.

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BREEDING PIGS FOR BACON.

By W. F. JACKSON, B.Sc., A.C.G.I., A.I.C.

Introduction.

THE launching of the Pigs Marketing Scheme has revived interest in pigs from all points of view. The new system of payment for quality in bacon-pigs, which is theoretically a sound principle, has focussed the attention of pig-producers on the problem of increasing their output of better quality pigs suitable for bonus payments. This is, of course, a natural result, and one which is only to be expected. The problem of grading-up a herd, however, is not by any means as simple as at first sight appears.

One recollects that some thirty years ago Denmark commenced improving the quality of her pigs. With only two breeds to consider, her difficulties were comparatively simple. Yet during the intervening period the processes of selection have been going on continually, and are still in operation. It is thus obvious that the problem presented by our multiplicity of breeds is not likely to be solved in a few months. It is even doubtful whether individual effort alone will be adequate for the purpose, and the establishment of breeding centres for the production and sale of stock of proved commercial qualities is foreshadowed.

Presuming for a moment that the problem of producing top-grade carcases is entirely one of breeding, it should be remembered that at the moment a carcase has been graded the dam of that carcase has already farrowed her next litter, and thus remedial measures are correspondingly delayed. It is also a fact that only an expert can predict the grade of a carcase from an inspection of the live pig; whilst the external characteristics of a weaner or store pig cannot be used to foretell the quality of the baconer. Grading-up will obviously take time: time which may be irksome and irritating to the producer who wishes to make progress.

The producer will also have another aspect of the matter to bear in mind. He will naturally desire to maintain, and indeed to increase, his measure of profit on each pig marketed. He has, therefore, to watch his production costs carefully and continuously. Steps taken to improve the general level of quality in his herd (as measured by factory grades) must therefore be carried out without increasing production costs. As an example, there are many feeders who might have to think twice before scrapping a stock boar that had proved himself suitable in every way in the past, but which is now regarded as responsible for the low grading of his offspring.

Factory Grades.—Bacon carcases are now graded with respect to thickness of back fat at the shoulder, and thickness of belly. A preference for white, or mainly white, pigs is expressed, whilst carcases showing soft fat after twenty-four hours' chilling are liable to a deduction. Other requirements are also stated in the form of contract, but are not discussed here as they are not directly connected with breeding.

The problems confronting the breeder of bacon pigs are therefore simply these : (*a*) To eliminate pigs which are coloured ; (*b*) to reduce the proportion of his pigs which show too large a measurement of back fat at the shoulder ; (*c*) to increase the thickness of the belly measurement ; (*d*) to ensure that his pigs will show firm fat after slaughter. It is considered likely that readers of this Journal are taking at least a general interest in problems of pig husbandry. A few notes on these problems may therefore be interesting, and even useful to veterinarians. We may first discuss the subject of

Colour in Baconers.

The objections of bacon curers to coloured pigs may be regarded as two-fold : namely, positive and negative. Positive objections are three in number. There is, first, the prevalence of " seedy cut," and unsightly melanotic coloration of the fat in the mammary region. This defect is mainly shown in females, but is inherited through the sire from the grand dam. It is only visible in coloured breeds. The use of either a coloured boar or of a boar whose dam was coloured as a bacon sire is, therefore, to be discouraged. The defective flesh has to be cut away from the side before curing, since bacon showing " seedy cut" is unsaleable. Secondly, coloured pigs are more difficult to scrape clean than white pigs, and, in any case, the roots of the coloured bristles remain visible in the cured produce, and give an unsightly article. Thirdly, bacon curers agree that the flesh of coloured pigs is somewhat coarse as compared with that of white or mainly white pigs. These positive defects are the result of using coloured boars, independent of the type of sow. The remedy is obviously to employ only white boars.

The " negative " objections consist in the fact that British curers have for years advocated the use of the large white boar as the bacon sire *par excellence.* In this view confirmation is forthcoming from every foreign country that sends bacon to our shores, in that each employs large white boars. The use of this

boar confers on the offspring such desirable attributes as length of side, leanness, fineness of bone, and many others, besides obviating the positive defects due to coloured breeds. It is thus apparent that the general adoption of large white boars for bacon purposes automatically solves the problem of the coloured pig. Some objections have recently been made to the policy of deductions for coloured pigs, the fear being implied or expressed that the scheme is intending to eliminate all coloured pigs by this form of economic pressure. It may therefore be categorically stated that no objection whatever has ever been expressed or implied against coloured sows as dams of bacon pigs; indeed, many excellent bacon pigs are derived from coloured dams. The scheme does not attempt any restrictive policy, so far as breeds are concerned. It merely desires to consider every pig on its commercial merits.

Thickness of Fat at Shoulder.

Certain practical considerations underly the decision to grade pigs by measuring the fat at the shoulder. In any given pig the shoulder region shows the maximum fat thickness; consequently a pig which passes the Grade A maximum prescribed for its weight can be classified as lean. Moreover, the fore end realises less money per pound than other parts of the carcase. A pig with thin shoulder fat is therefore presumed to have a light fore end. In order to qualify for a bonus in this respect, pigs should not be abnormally fat, and should have a light neck, with no tendency to a " poll " of fat behind the ears. It can be appreciated that the problem of obtaining this pig is largely a breeding one, but feeding and management may have a considerable influence. Specimens of pigs with thick, heavy and broad shoulders, and showing this hump behind the ears are to be found in most of our pure breeds.

On the assumption that these characters are liable to appear in the offspring, boars and gilts intended for breeding commercial pigs should be beyond reproach in these respects. Curers have frequently stated their preference in the past for certain breeds or crosses; these statements are based, of course, upon experience, and are valuable to the extent that, on averages, animals so bred have been found to provide carcases closely resembling the curer's ideal type. They do not suggest that every specimen of the breed or cross in question will *ipso facto* pass the grading test; in other words, the breeder is still responsible for selecting his individual breeding animals. Given a boar and sows of suitable shoulder conformation, it does not invariably follow that the offspring will be found to pass the fat-grading test. Disturbing factors come in, and amongst these one may refer briefly to two.

If feeding or management are such as to encourage the laying on of fat as opposed to growth, it may happen that the pig, on reaching bacon weight, will be excessively fat all over, and will therefore be graded down. One may suggest one or two ways in which this excessive fat formation may come about. Pigs which are confined in a yard or other building where movement is restricted, but whose temperature is low, will tend to lay on fat as a protective insulating covering. The remedy is obviously to choose buildings which are warm. A

ration unskilfully compounded, which contains an unduly high proportion of starchy foods, will probably have the same effect. A ration may be, on the other hand, a good one, but may be defective in some important growth-promoting ingredient. Slow growth, resulting in a tendency to fatness, will follow. Lastly, pigs inheriting a weak growth-impulse from their parents may also cease to grow, and start to fatten sooner than is expected.

On the other hand, pigs which are housed in warm draught-proof surroundings, and fed rations rich in protein and minerals, balanced as carefully as possible, are so busy growing in length that there appears to the observer to be no definite fattening stage. The possession of a long frame naturally tends to minimise the thickness of the fat layer, and may give one an impression that the pig is unfinished. A rather useful example of this which illustrates the whole thing very well, is in connection with Large Whites. The tendency in the past having always been to promote fat formation in every possible way, it is not surprising to find that many conservative pig feeders regard the Large White as useless, a bad doer, too slow in growth, and so on. The truth is, of course, that other breeds start to fatten long before the Large White has ceased to grow, and the eye may give the impression that the Large White is backward. The weighbridge, however, proves conclusively that the Large White, as regards weight for age, has no superior (*cf.* for example, the weights of the Smithfield Show pigs).

Feeding, housing and management must therefore be adjusted so as to discourage fattening, particularly where pigs possess an abnormally high tendency to fatten. So far as feeding is concerned, one may submit that most rations are deficient in protein foods. There is usually no risk in increasing the proportion of these, provided always that minerals, etc., are raised correspondingly. An increase of one or two per cent. in the amount of protein food, which involves a similar percentage decrease in the carbohydrates, makes a very significant alteration in the ratio of the two.

Thickness of Belly.

A side of bacon showing no streak is, of course, anathema to the retailer. The belly measurement thus furnishes another useful criterion as to the suitability of a carcase for bacon curing. The measurement is taken on a line between two nipples, and on a level with the top of the kidney. Undoubtedly the tendency to thick or thin belly is inherited. But it is very likely that this characteristic is more susceptible to external influences than is the back-fat thickness. One prominent disturbing factor is well established. The feeding of too much thin watery food to young pigs results in an obvious condition called " pot-belly." If this treatment is prolonged the condition becomes a permanent distortion, and is subsequently evident on slaughter. This being the case, it is also highly probable that continuous overfeeding may bring about the same undesirable result, as also may the use of food which is only slowly digested. Comparatively thick, stodgy food is never incorrect for pigs ; a supply of water may be given for the

pigs to help themselves in hot weather. Under-feeding also is always safe, because pigs will invariably grow faster when their stomachs are not completely filled.

Texture of Fat.

Pigs are like all other animals so far as is known, in that they can absorb oils from the food and build them into their adipose tissue, side by side with fat synthesised from starch. This gives rise to the defect known to bacon curers as soft fat. Obviously the amount of oil in the ration is the ultimate deciding factor as to whether soft fat shall arise or not. Rations containing no oil whatever are practically impossible to devise. On the other hand, excess of oil is a common feature in pig rations. Experience suggests that rations containing more than $2\frac{1}{2}$ per cent. are extremely liable to cause soft fat, and, *per contra*, a lower percentage is comparatively safe in this respect.

It is, however, obvious that all sorts of extraneous factors must have some influence on the actual result. Presuming for a moment that the above proportion represents the maintenance allowance which the pig burns up or otherwise converts, it will be apparent that weight, size, rate of growth, temperature of pen, time of year and many other influences may have a decisive effect. It is thus possible that some pigs fed on a ration showing 2.7 per cent. of oil may show firm fat, whilst others fed under different conditions on a ration having 2.3 per cent. of oil may give soft fat on slaughter. A safe rule, then, is to minimise the amount of oil in the ration, so that it is well below the safety limit (2.5 per cent.), and to do everything else to encourage rapid growth. Although fat texture is not directly a breeding problem, it is possible that breeding has an indirect influence. This, together with the importance of the subject, must be the excuse for including this subject in a discussion on breeding points.

This concludes a brief summary of the various breeding factors which the feeder may bear in mind as affecting the price which he receives for his pigs from the curer. Now we may pass on to consider the

Influence of Breeding on Costs of Production.

This is obviously a wide subject, and we may well define it by limiting ourselves to a discussion of the influence of pre-weaning factors on the cost of producing the baconer. The practical importance of this matter arises somewhat in this way. The price paid by curers for a basic pig (Class 1, Grade C) is regulated by a formula, which includes a fixed price for the weaner, a fixed price for the overhead charges involved in converting the weaner to a baconer, and a variable portion representing the cost of 6 cwt. of food. The various items are calculated on a reasonably generous scale, so that each includes a possibility of profit to the producer.

If it is desired to obtain the maximum profit possible under each of these headings, a close scrutiny of every operation involved must be maintained. We may thus ask: in what respects, and to what extent, can the newly weaned pig influence the cost of production of the baconer? In order to give some ideas on this question, the first point to consider is the cost of producing the weaner.

Cost of Producing the Weaner.

It may be stated that every stage prior to weaning has some effect on this item. With regard to the boar, he must stock his sows at the first service, since a three-weeks' lapse on the part of the sow is wasted time. Boars must, therefore, be kept in lean, hard condition with moderate exercise, and on a reasonable amount of nourishing food. Other factors influencing the potency of the boar are well known, and need no detailed discussion. It may, however, be mentioned that the more sows serviced by one boar, the cheaper is each service, always provided that no strain on him is involved. No actual figures can be quoted here, but two or three services in a week ought to do no harm to a boar that is carefully managed.

Sows must hold to their first service, which should take place within five days of weaning. Failure to hold may be due to disease, but if the phenomenon is widespread, it points to a defect in the food. Sows should be in rising condition when served; to this end the amount of food given may be steadily and fairly rapidly reduced during the eighth week of suckling, until the milk has dried up. Then increase somewhat, the food being rich in protein, which will help to bring the animal on heat. A deficiency of calcium in the food of sows will cause widespread failure to breed, and it is possible that other nutritional factors may also affect matters similarly. It is therefore advisable not to condemn a sow too hastily. The sow is expected to rear eight pigs to eight weeks old, and the cost of producing the weaner rises proportionally if the number is not forthcoming. In order to achieve this result, the breeder endeavours to select females from prolific strains, since the tendency to produce large litters is undoubtedly inherited. Other factors, however, must receive suitable attention.

It is now well known that in all normal cases from twenty-five to thirty eggs are fertilised in each sow. These usually atrophy and perish one by one as pregnancy advances; and the general reason appears to be some defect in the food supply. The law of the minimum applies here, and the sow prefers to bring forth a few perfect pigs rather than a plethora of imperfect ones. Greater attention to the " quality " of the food given to in-pig sows is required: in particular one would mention the supply of calcium, chlorine, iodine and vitamins.

The in-pig period is also important in another respect. It is a preparation for lactation, and one may submit that the milk yield of the sow has largely been settled before farrowing takes place. Subsequent feeding may do little to influence the amount of the milk. The milk yield depends upon high feeding during the later stages of gestation. Then, again, pigs which are farrowed by a sow that has been indifferently fed will at best have weak constitutions, and are thus handicapped at the start. Subsequent treatment seldom if ever succeeds in making them into commercial assets. To sum up, the number of pigs born and the number and weight of pigs weaned is largely influenced by feeding during gestation. Up to the age of three weeks the pigling eats practically nothing but its mother's milk. From that age onwards, however, its desire and capacity for eating solid

food rapidly increases. The skilful breeder takes advantage of this, and provides a creep for the youngsters where they may feed out of reach of the sow. Soaked barley grains, to be followed by dry barley meal, are suitable for this purpose ; subsequently, a dry mixture of easily digested balanced foods may be given. Dry food appears to be better than slop in that the former stimulates the little pig to suckle ; however, where skim milk is available, it may be offered in small amounts. Creep-feeding, if carefully carried out, will assist very considerably in increasing the weight of the pigs at weaning. A weaner that weighs 33 lb. at eight weeks has already saved one week of the fattening period.

Lastly, one may refer to a more obscure problem. It is fairly obvious to those who handle pigs in considerable numbers that some newly-weaned pigs are externally more promising material for the fattening house than others. The majority of pig producers are capable of selecting with ease and certainty the bad-doers from a bunch of stores. To a certain extent the behaviour of pigs subsequent to weaning seems to have been settled for better or worse while they were still suckling. We may spend a few moments discussing this aspect of the problem.

The actual size or weight of the pig is likely to be used as one means of discrimination ; we have already referred to this. Then there is the subject of worms, and the importance of ensuring that these be got rid of as quickly as possible is patent to all. A more obscure problem is the matter of the inherited growth impulse. It has always been felt that the capacity to put on flesh at an economic rate is inherited, and can therefore be transmitted at will. Actual experiments, which substantiate this idea, have recently been made at the Institute of Animal Genetics at Edinburgh. Taking the weight of food required per pound of gain as the criterion, it was found that this could be improved (*i.e.*, diminished) very considerably by judicious matings, and that the boar has a material influence on the result. The importance of recording the progress of every litter by measuring the time taken to reach a standard bacon weight, and of using this information in order to grade-up the herd, will thus need no emphasis.

There is just one further feature by which it may be said that the success or otherwise of the weaners is largely determined during their pre-weaning history. This relates to the supply of vitamins. It appears that pigs do not require vitamin C, and as regards vitamin B they obtain sufficient from their cereal foods to keep them well supplied from day to day. With regard to vitamin A (the growth-promoting factor) and vitamin D (the rickets-preventing factor), these appear to be capable of storage in the body to a certain extent. If the milking sow is well supplied with these vitamins through food or greenstuff, her milk should be vitamin-rich, and she will thus ensure a reserve in her offspring.

Pigs thus endowed, and which have become accustomed to solid food whilst suckling, ought to bear the separation from their dam with impunity, and, other things being equal, should make a good start in their post-weaning existence. Sunlight and exercise on pasture for the milking sow would thus appear to be

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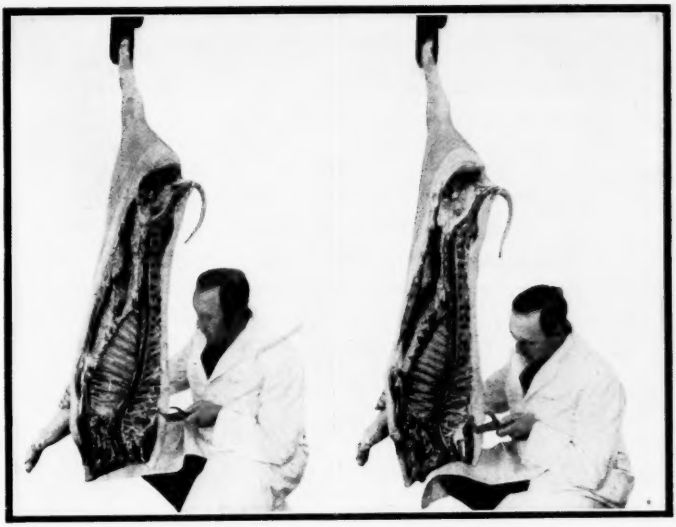

A "Grade A" Carcase.
Note position of callipers for measuring back fat. (Belly being measured opposite top of kidney.)

A "Grade C" or "Basic Pig."

(By courtesy of Messrs. Marsh & Baxter, Ltd.)

(*Article by* D. J. Anthony, M.R.C.V.S., D.V.S.M., *page* 109)

Siamese Twin Piglets.

(*Article by* John D. Peele, M.R.C.V.S., *page* 139).

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extremely valuable. Linked up with these problems, of course, are such phenomena as the occurrence of runts or dollies, and the whole subject of weak constitution. In the past the prolificacy of the sow, and the custom of knocking on the head all those piglings which give promise of no financial return, have rather tended to leave some of these phenomena in obscurity. To those, however, who are endeavouring to maintain an average rate of eight *healthy* pigs per weaned litter, twice a year, the subject obtrudes itself very forcibly.

I trust that I have said sufficient to indicate some of the lines in pig-breeding which are assuming prominence under present conditions. In solving any or all of these difficulties, the sympathetic understanding, and indeed the helpful co-operation, of the veterinarian will be appreciated by pig-producers.

THE PORK AND BACON TRADES.

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PRIOR to 1934 one could safely state that about half the total quantity of pig meat marketed in Britain was converted into bacon and hams, the remainder being consumed as fresh pork. In 1925, a census of pig production classified a sample of 700,000 fat pigs as follows: 47 per cent. baconers; 46 per cent. porkers, and 7 per cent. sows. This classification refers to weight and conformation, as well as suitability for the various classes. It does not necessarily follow that the whole 47 per cent. baconers were converted into bacon, nor that the 46 per cent. porkers were all sold as fresh pork. Some part of the latter class (" cutters "—100 to 140 dead weight) may be used for the manufacture of hams or bacon if there happens to be a great demand for that commodity at the time.

Pork.

The period of greatest demand for pork is between the months of September and April. The pork pig is a younger and therefore smaller pig than the baconer, and the dead-weight classification for pork is as follows: Porkers from 60 to 80 lb. (3 to 4 score); porkets from 80 to 100 lb. (4 to 5 score); cutters from 100 to 140 (5 to 7 score). Pigs over seven score dead-weight are usually included in the bacon-pig class.

Prior to 1926 there was a large and flourishing import trade in fresh pork from Continental countries, but owing to the discovery of foot-and-mouth disease lesions in imported pork carcases from Holland and Belgium, an embargo was placed upon that trade. The sudden cessation of supplies from the Continent was compensated for by an increase in the importation of pork carcases from Ireland, as well as increased supplies from home producers. In 1909, about 6.6 per cent. of the total pig meats imported were in the form of fresh pork, and this increased until the outbreak of war in 1914. Most of the Continental pork

was consumed in and around London, while about 10 per cent. was sent to Scottish bacon factories to be cured and sold as Ayrshire bacon.

Frozen pork has been imported into this country at various times from the United States of America, Argentina, Brazil, Uruguay, New Zealand, Canada, China, South Africa, the Baltic States and Soviet Russia. About the middle of the War, in 1916, there arose a great demand for frozen pork, and of the imports the United States sent us about 86 per cent., China and Argentina supplying the remainder. New Zealand has since been the chief supplier.

Salted pork, which is the form in which pig meat was originally imported here before the discovery of refrigeration, is now imported in very small quantities from the United States and Denmark, whilst some canned pork comes from the United States, Canada, Argentina and Denmark.

Most of the fresh pork consumed in this country is now home produced, but up to the present there is no marketing scheme for the pork trade, pigs being purchased either direct from the producer through dealers, agents or auction markets, at prices which vary weekly. The prices may be according to live or dead weights, the favoured method being a dead-weight price at so much per score (20 lb.). Present tendencies seem to indicate that the pork trade will in future be controlled under some marketing scheme, and possibly legislation may be introduced making it compulsory to purchase supplies only on a dead-weight basis. The bulk of the home-produced pork is sold in butchers' shops throughout the country, and is not largely confined to certain areas, as is the case of the curing of bacon.

Bacon.

The bulk of this commodity is produced in large factories situated in the West of England and the Midlands, relatively small quantities being cured by pork butchers and on farms. With the rapid industrialisation of the country and the erection of new housing estates everywhere, the day of the " cottager's pig " and " home-cured bacon " has passed away, and in its place we have the concentration of slaughtering and curing in large factories where mass production methods are in vogue. It may be interesting to note that mass production in other industries is merely copied from the meat trade, the " packing houses " of Chicago being the originators of this large-scale producing method.

Prior to the introduction of the marketing schemes for pigs and bacon in the winter of 1933, about five-sixths of the bacon consumed in this country was imported. In 1924 our imports amounted to 66 per cent. of the consumption. Bacon and hams came from Denmark, Sweden, United States, Canada, Ireland, Poland, Lithuania, Russia, etc. The Danish bacon trade has always been well organised, and as Denmark is near to its market in this country, its bacon can be sold here within two weeks of slaughtering, and can therefore be sent in a fresh, mild-cured condition, and regularly distributed.

The United States supply a cheaper class of product, such as Cumberland cuts, picnic hams, and cut meats. The cuts are sent in boxes containing 500

to 525 lb. of meat, packed in dry salt, and graded in various ways. Canada sends chiefly Wiltshire-cut sides. Some frozen pork from New Zealand, South Africa and Australia is also imported for curing here, but this does not give a very high-class product.

Classification of Bacon.—This is according to " selection," " weight " and " quality."

Selection.—On the basis of the " build " of the side, and the proportion of fat to lean : Wiltshire-cut sides being classed as " leanest," " lean," "medium," and " stout."

Weight.—" Extra light," sides less than 42 lb. ; " sixes," sides from 42 to 48 lb. ; " sizeable," sides from 50 to 66 lb. ; " medium," sides from 67 to 84 lb. ; " heavy," sides from 84 lb. and upwards.

Quality.—According to the shape, selection, quality, etc., of the meat, it is classified as " full-branded," " half-branded," or " unbranded."

The Wiltshire-cut side may be dry-cured or tank-cured and smoked, and consists of the whole side, including the ham, but minus the head and shanks. In the Midland trade the bacon is usually dry-cured, and the hams are cured separately and sold as " York hams." Smoked bacon is chiefly sold in the West and South of England and London, whilst the dry-cured or " green " bacon sells chiefly in the North and Midlands. In the Midland trade the pig carcases are divided into " lean-backed " and " fat-backed " classes, and from the former are made the " special cut " sides of bacon. In the case of the " fat-backed " carcases, the ham, head, forehock, feet, tail-piece and breast bone are removed. The " loin " (spine) is removed also, and the remainder of the side cured as a " shoulder-belly." Both " specials " and " shoulder-bellies " may be sold " rib-in " or " rib-out," the latter fetching from 2*s.* to 3*s.* per cwt. more than the former.

Marketing Schemes.

In September, 1933, the Minister for Agriculture and Fisheries set up two Boards to control the marketing of pigs and bacon. One, known as the Pigs Marketing Board, represents the farmers and producers, whilst the Bacon Marketing Board represents the bacon curers. The condition of the pork and bacon trades as well as pig production in this country had already been investigated and reported upon, so that Government action was expected. Briefly, the result of setting up such Boards is to enable the pig industry in this country to become highly organised and efficient, so as to encourage the production of more home-bred pigs and British bacon, eventually enabling the country to become self-supporting in this commodity.

Contract forms are drawn up by the Pigs Marketing Board, enabling farmers and producers to contract direct with the curers to supply a given number of pigs spread evenly over a specified period. In return for this, the farmer is guaranteed a fixed price which does not fluctuate every week as it used to do.

This price is agreed upon by the Board, and is based upon the cost of pig food, but is sufficiently high enough per score dead-weight to enable the producer to make a profit on his pigs, provided such pigs fall within the categories required by the curers under the contract. These contracts are legal documents, and are registered with the Pigs Marketing Board, London.

As the public will not eat fat bacon, lean pigs are in demand, and the grading of the carcases is done jointly by the representatives of the curers and Pigs

Classification and Grading of Bacon Pigs.

CLASSIFICATION AND GRADING OF PIGS.

1. Each pig shall be classed according to its dead weight and graded according to the measurements of its shoulder fat and belly thickness on arrival at the Curer's factory in accordance with the scale and conditions following, namely:—

Grades.	Class 1. Dead Weight 7 sc. to 8 sc. 10 lb. (incl.)	Class 2. Dead Weight 8 sc. 11 lb. to 9 sc. 10 lb. (incl.)	Class 3. Dead Weight 9 sc. 11 lb. to 10 sc. 10 lb. (incl.)	Class 4. Dead Weight over 10 sc. 10 lb.
A. Maximum fat measurement / Minimum belly measurement	1¼" and 1½"	1½" and 1½"	2" and 2"	Any if suitable for the manufacture of bacon for the Curer's trade requirements.
B. Maximum fat measurement / Minimum belly measurement	1¼" or 1½"	1½" or 1½"	2" or 2"	do.
C. (Basic) Maximum fat measurement / Minimum belly measurement	2" and 1½"	2½" and 1½"	2½" and 1½"	do.
D. Maximum fat measurement / Minimum belly measurement	2½" and 1"	2½" and 1½"	2½" and 1½"	do.
E.	Any pig failing to grade as A, B, C or D, which the Curer accepts for curing. (The belly measurement as regards Grade C shall be increased one-eighth beyond these figures in the last 4 months of the period covered by this Contract.)			

Every pig when graded shall be deemed to be within the highest grade applicable to its measurements but no pig shall be deemed to be within Grade B unless conforming at the least to both measurements in Grade C.

In any case when a pig is graded with its skin off the fat measurements above set out shall be reduced by ¼ in. and the belly measurement by ½ in.

PROVIDED ALWAYS that no pig shall be deemed to be within any of the aforementioned grades which

(*a*) Has not firm white fat, or
(*b*) Shows fishy flavour or seedy cut, or
(*c*) Was not castrated within 12 weeks after birth, or
(*d*) Is a ripsig, sow, or pregnant pig or not a maiden gilt, or
(*e*) Suffers from any disease rendering it unsuitable for the manufacture of bacon, or
(*f*) Has bruises, broken bones or other physical damage rendering it unsuitable for the manufacture of bacon, or
(*g*) Is emaciated (i.e., a "screw" pig).

2. **WEIGHT FOR CLASSING.**—(*a*) The expression "dead weight" means the weight (after the animal heat has departed) of the dressed carcase including the head with tongue, kidneys, tenderloins, fleck or flare, tail, backbone and feet.

(*b*) If any pig is weighed before the animal heat has departed the scale for shrinkage from hot to dead weight shall be as follows:—

Weight (hot).	Shrinkage.
7 sc. 4 lbs. to 8 sc. 14 lbs. (inc.)	4 lbs.
8 sc. 15 lbs. to 9 sc. 15 lbs. (inc.)	5 lbs.
9 sc. 16 lbs. to 10 sc. 16 lbs. (inc.)	6 lbs.
10 sc. 17 lbs. to 12 sc. (inc.)	7 lbs.

Over 12 sc. an additional 1 lb. for each extra score or part thereof.

(*c*) If any pig delivered is weighed cold with its hair on a deduction of 4 per cent. shall be made from the dead weight.

3. **MEASUREMENTS FOR GRADING.**—(*a*) All measurements shall be taken with standard pattern gauges authorised by the Board for that purpose in agreement with the Bacon Marketing Board.

(*b*) If any doubt or dispute shall arise as regards a measurement taken before the animal heat has departed, it shall be retaken after such heat has departed.

(*c*) The belly measurement shall be the thickness of the belly 1½" in from the belly edge opposite the joint between the 4th and 5th vertebrae from the curve.

(*d*) The fat measurement shall be taken at the fattest point on the shoulder or in the case of a malformed pig at its fattest point on the back.

Marketing Board. The country is divided into areas, over which grading supervisors are appointed to watch the interests of the farmers. Under the supervisors there are graders who are stationed in various districts for duty in the bacon factories in the area. Thus the Pigs Marketing Board safeguards the producer's interests, and payment for the pigs is made on the grading of the producer's and curer's representative at the factory. A fixed price per score (20 lb.) dead-weight is agreed upon for a "basic" grade pig. Should the carcase be graded higher than "basic" (which is grade C), additional payments amounting to about 6*d*. per score per grade are made on this basic price, whilst deductions of about 3*d*. per score grade are made if the pigs do not come up to the basic standard, or are in heavier classes.

A black pig is not paid for on the same basis as a white pig, about 6*d*. per score being deducted according to grade.

Insurance.—An insurance scheme is run in conjunction with the marketing scheme, for which producers and curers pay a levy of about 3*d*. each per pig. Thus, condemned meat is insured against, provided the disease for which it was condemned was not reasonably apparent at the date when the pig was despatched from the producer's farm.

Bacon Marketing.—As the price per score to the farmer is now fixed for months ahead, it was essential to safeguard the curers so as to enable them to pay this price. To do this a quota was fixed for all bacon imports into this country, and the Government also placed a sum of money at the disposal of the curers in the form of a short-term loan, so as to enable them to make up the difference between the price paid for pigs and the low selling price of bacon. Fortunately little of this money has been required, and the scheme is gradually improving, and taking on a co-partnership basis between curer and farmer, the profits of the one being shared with the other, and by this means it is hoped to make Britain a self-contained unit as far as the supply of bacon is concerned.

The cost of running these schemes is borne by the producers and curers, a levy being made for this purpose by the Pigs Marketing Board and the Bacon Marketing Board. Certain difficulties, often unforeseen, were bound to arise in the early stages of such a plan, but as these difficulties are gradually being surmounted, a scheme is being evolved which cannot fail to be of incalculable benefit to producers, curers, and the nation in general.

NECROTIC ENTERITIS (PARATYPHOID) AND ITS DIFFERENTIAL DIAGNOSIS.

By E. F. BECKETT, F.R.C.V.S.

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WITH the discovery in 1904 of the virus of swine fever, Salmonella infections of the pig have been relegated to the background, although prior to that time *Salmonella suspestifer* was regarded as the cause of the disease. This organism is considered by many to be a normal inhabitant of the bowel of the pig, only becoming pathogenic when the resistance of the body is lowered; in animals infected with the virus of swine fever, *Salmonella suspestifer* is present in the ulcers, in the mesenteric and other lymphatic glands. While for years *Salmonella suspestifer* has been considered as only a secondary or associated organism, it must now be realised that it may act independently of the virus, and in such cases the disease is in reality infectious necrotic enteritis.

In view of the opinions expressed by a number of veterinarians in Great Britain during the last few years, it is apparent that some doubt has existed as

to the presence of the virus in outbreaks of so-called mild swine fever. While the writer has collected data in connection with the various outbreaks with which he has been associated, it was during investigations carried out during an outbreak in a large herd that the most reliable material was obtained; it is therefore thought desirable to discuss briefly this herd, its objects and methods of management. The number of pigs in the herd was roughly 4,000, and consisted of pedigree and cross-bred animals. The primary object for which the herd was maintained was the production and sale of bacon pigs of 200–220 lb. at 6½–7 months old. Periodical sales of pedigree stock were arranged, and also the marketing of porkers to suit existing markets. Berkshire, Large White, Tamworth and a small number of Large White Lop-eared pigs were kept. The Berkshire herd was founded in 1918, and gilts of the best type were purchased from the leading breeders. They were chosen for length and fineness of shoulder, with the object of producing a good type of bacon pig by crossing gilts from these herds with either Large White or Tamworth boars. The management fell into three actions:

(1) *Breeding.*—Two systems were in existence:

(*a*) *Permanent Breeding Depots.*—Following service, the sows were turned out on the grass plots. There was a large wooden shelter in each plot, and the number of pigs carried per acre was five to six. The sows remained in the plots until a week before farrowing, when they were taken into the farrowing pens. They remained in the pens from four to fourteen days after farrowing, the length of time depending on weather conditions, and each sow was then moved into a sty with access to one-fifth of an acre of grass. The pigs were weaned at eight weeks.

(*b*) *Movable Breeding Depots.*—These consisted of small movable pens (36 feet by 27 feet), with a portable wooden shelter in each. The pen accommodated either three dry sows or a sow and her litter.

(2) *Store Pigs.*—Both pedigree and cross-bred stores were kept in open field-pens, the size of which was 36 feet by 27 feet. When practicable, each litter was kept in a separate pen. The store period lasted from eight to twenty weeks.

(3) *Fattening Pigs.*—At the age of twenty weeks the store pigs were brought into the fattening depots, each of which contained about 300 pigs. These depots were divided into yards, and each yard accommodated from 25–30 animals. The pigs remained in these yards about one month, after which they were placed in sties for the final fattening.

Rations.

The composition of the rations when the outbreak was at its height was as follows:

No. 1.—For Suckling and Steaming-up Sows.

Composition.—13 parts soya bean meal, 22 parts barley, 20 parts middlings, 15 parts pollards, 10 parts manioc meal, half part cod-liver oil, 10 parts whey paste, 2 parts seaweed salts, 1 part minerals.

Analysis.—Moisture, 13.1 ; protein, 16.0 ; oil, 3.4 ; fibre, 5.7 ; carbohydrate, 56.3 ; ash, 5.5.

Digestible Nutrients.—Protein, 13.6 ; oil, 3.0 ; fibre, 3.2 ; carbohydrates, 48.7 ; starch equivalent, 71.18.

Manurial value to the nearest 6*d.*, 21*s.* per ton.

No. 2.—For Store Pigs, one Fortnight after Weaning.

Composition.—13 parts soya bean meal, 35 parts barley, 15 parts middlings, 15 parts pollards, 12 parts manioc meal, 10 parts whey paste, 2 parts seaweed salts, one part minerals, half part cod-liver oil.

Analysis.—Moisture, 12.5 ; protein, 18.0 ; oil, 2.5 ; fibre, 5.3 ; carbohydrates, 56.6 ; ash, 5.1.

Digestible Nutrients.—Protein, 15.3 ; oil, 2.2 ; fibre, 3.0 ; carbohydrates, 48.7 ; starch equivalent, 10.9.

Manurial value to the nearest 6*d.*, 21*s.* 6*d.* per ton.

No. 3.—For Dry Sows and Store Pigs.

Composition.—9 parts soya bean meal, 40 parts barley, 12½ parts middlings, 12½ parts pollards, 15 parts manioc meal, 10 parts whey paste, 2 parts seaweed salts, 1 part minerals, half part cod-liver oil.

Analysis.—Moisture, 13.4 ; protein, 14.3 ; oil, 3.4 ; fibre, 5.0 ; carbohydrates, 59.5 ; ash, 4.4.

Digestible Nutrients.—Protein, 12.2 ; oil, 3.0 ; fibre, 2.9 ; carbohydrates, 51.5 ; starch equivalent, 72.72.

Manurial value to the nearest 6*d.*, 19*s.* 6*d.* per ton.

No. 4.—For Fattening Pigs.

Composition.—4½ parts soya bean meal, 45 parts barley, 10 parts middlings, 10 parts pollards, 18 parts manioc meal, 10 parts whey paste, 2 parts seaweed salts, one part minerals.

Analysis.—Moisture, 11.8 ; protein, 12.8 ; oil, 3.2 ; fibre, 5.0 ; carbohydrates, 61.3 ; ash, 5.9.

Digestible Nutrients.—Protein, 10.9 ; oil, 2.8 ; fibre, 2.9 ; carbohydrates, 53.0 ; starch equivalent, 72.2.

Manurial value to the nearest 6*d.*, 18*s.* per ton.

Feeding.

Except for pigs in the final fattening stage, the animals were practically dry-fed throughout, the rations being as follows :

Suckling Sows.—These received about 112 lb. per week. This varied according to the size of the litter. *Steaming-up Sows.*—These received 42 lb. during the week preceding farrowing. *Dry Sows.*—28 lb. a week during the summer,

and 35 lb. a week during the winter. *Store Pigs.*—25 to 28 lb. per week. *Fattening Pigs.*—45 to 50 lb. per week.

At the permanent depots one man was employed for every 55 breeding sows, or for every 150–200 fattening pigs. In the fields one man and one horse were employed for every 40 breeding sows, or for every 200 store pigs. All pigs were ear-marked and as far as possible complete records were kept from birth onwards.

It was not until 1925 that the losses sustained were greater than might be reasonably expected on premises where pigs were maintained in large numbers, but with the advent of that year, losses began to increase at an alarming rate. The first deaths took place in pigs from eight to twelve weeks old, and later in pigs up to six months old. While the greatest number of deaths took place in animals between the ages of eight weeks and five months, the death-rate among adult animals of both sexes was negligible.

Symptoms.—While the disease may be either acute or chronic, it usually assumes a chronic course, and is characterised by a low mortality and morbidity. In affected herds the initial symptoms appear at about three weeks old, and in white pigs one is struck by the pale colour of the animals; the faint pink tinge that one associates with the skin of the young pig is absent, and because of the paleness of the skin the eyes look unduly prominent. The skin has an unthrifty appearance. While the pigs are to some extent listless, they appear to carry flesh until about the fifth week, when they begin to loose condition. In many cases the ears and other parts of the body become blue. "Thumps" is a common symptom and profuse diarrhœa occurs at any time between the third and fifth weeks. In the case of stores and fattening pigs, the first indication of the onset is that one or more animals show a disinclination for food. They may come to the trough, but soon give up any attempt at feeding. They stand about with hanging heads and tails down, which gives them a woefully dejected appearance. In the early stages the temperature is elevated, but in animals that survive the acute stage there is little rise in body temperature. The skin presents a scurfy, unhealthy appearance, and this may be complicated in the case of animals kept in the fields, by weather conditions; pigs, particularly white ones, kept in the open during the summer frequently suffer from sun-burn. It is this condition, aggravated by the animal's rubbing as a result of the irritation, that has caused uninitiated observers to suspect mange. Constipation may be noticed, but in a large herd this often passes unobserved, and the first indication of the alimentary tract being affected is profuse diarrhœa accompanied by a most offensive odour.

Provided death does not follow the acute stage, the animals lose flesh, growth is retarded, and there is a general appearance of unthriftiness. Weakness of the hind limbs is present; later the animals lie about, are difficult to get up, and death finally ensues from weakness and exhaustion. Anæmia is common, and almost invariably found in chronic cases. A rough method of making a blood count is the hæmoglobins scale (Tallqvists' pattern).

In affected herds the post-mortem lesions shown vary to some extent according to the age of the animal ; in very young sucking pigs the lesions found consist of a general anæmic condition of the carcase, the heart appears dilated, the lungs being crushed back behind it. There is often great effusion into the pericardial, pleural and peritoneal cavities ; this fluid contains large coagulated flakes. The lungs are frequently œdematous. The liver and kidneys are pale in colour, and the spleen in most cases enlarged. In sucking pigs that are approaching the weaning stage a considerable length of the intestine is found to be acutely inflamed, and in the small intestine this may consist of long streaks down the length of the bowel. In these cases the mesenteric lymphatic glands will be found to be swollen and œdematous. It is in the store and early fattening stage that post-mortem lesions are most constant and typical ; while the lesions are confined chiefly to the intestinal canal and its associated glands, other organs in the body show well-defined changes. The lesions in the intestines are confined more especially to the large intestine, although the small bowel is frequently affected. In acute cases the bowels show a severe inflammatory condition ; this inflammation may consist of streaks down the length of the bowel, or the whole bowel may be bright- or dark-red. In animals that have survived the acute stage the lesions shown are most varied. In mild cases it may amount to no more than a slightly roughened and swollen appearance of the mucous membrane, but in more chronic cases severe necrosis, diphtheresis and ulceration are found. The deposit in the bowel shows three distinct forms or stages, with a possible fourth, and are as follows : (*a*) Slightly roughened appearance of the mucous membrane ; (*b*) a thin greyish-yellow deposit, about one-sixteenth of an inch in depth, which cannot be rubbed off ; (*c*) a thick greyish-yellow deposit one-eighth of an inch or more in depth—this is easily wiped off, leaving the mucous membrane roughened in appearance, very like the appearance described under (*a*) ; (*d*) a thin black deposit has been frequently found which cannot be rubbed off—this has been described by other writers as being due to the deposition of iron on the mucous membrane.

The ulcers associated with necrotic enteritis are flat, and when healing often have a blackish edge. It is the confluence of these ulcers together with diffuse diphtheritic necrosis of the mucous membrane which gives the intestine an appearance of a thick-walled tube so aptly described by herdsmen as " hose-pipe " gut. Scars are commonly found where resolution has taken place, and these vary from small circular areas to long scars extending as far as 1–2½ inches down the length of the bowel.

While changes in the glands throughout the body have been noticed, the glands chiefly affected are the mesenteric glands. These glands are hypertrophied, may be caseated, and œdema is present in varying degrees.

In acute cases enlargement and congestion of the liver is common, while in chronic cases cirrhosis of this organ is almost invariably present. The spleen is very often enlarged. The lesions found in the kidneys are important in view of

the diagnostic value of petechial hæmorrhages in swine fever. In the vast majority of cases the kidneys are pale in colour, but it is true that occasionally petechial hæmorrhages are met with, and, when present, these hæmorrhages are very small in size and extremely few in number. Pulmonary lesions are common, and these usually affect the lower lobes, although cases are not infrequent where caseation occurs, and the lungs are one solid greyish-red mass, firmly adherent to the chest wall. During the period over which these investigations were carried out, most careful examinations were made on the comparatively few adult animals that died, and in no case was evidence of necrotic enteritis found. At one time a scare occurred when several sows went down with paralysis of the hind quarters immediately after farrowing a healthy litter in an apparently normal manner; calcium injections (chiefly dextro-calcium) were tried, and the result was spectacular.

The differential diagnosis from swine fever may not be simple, but a reasonably accurate diagnosis should be possible in most cases. Swine fever is the only common disease in this country that spreads rapidly, affects animals of all ages, and is highly fatal. Necrotic enteritis, on the other hand, is characterised by a low mortality and morbidity, coupled with the time factor; further, adult animals are rarely, if ever, affected. In herds affected by necrotic enteritis, anæmia and diarrhœa in sucking pigs invariably precedes the attack; also in outbreaks investigated by the writer, infestation by ascarid worms has invariably been present.

The numerous hæmorrhages found in the skin, subcutaneous tissue, membrane of the thoracic and abdominal cavities and their organs are lesions associated with the virus of swine fever. The enlarged œdematous mesenteric lymphatic glands are typical of necrotic enteritis. Owing to the greatly exaggerated importance of ulceration in the diagnosis of swine fever, the writer is loth to embark on the difference between the type of ulcer found in necrotic enteritis, and that of swine fever; in the past the presence of ulceration of any kind has been sufficient to produce a state of mental panic among veterinarians and others concerned with these outbreaks. It must be clearly understood that ulceration *per se* is not diagnostic of swine fever; but it may be wise in passing to remark that the so-called button ulcer with its concentric layers and central depression is never seen in necrotic enteritis.

While the writer has had cases of swine erysipelas confirmed in pigs as young as eight weeks old, and has found it common in adult animals, it most frequently attacks young fatting pigs of medium size. The greatest losses from the disease occur during the summer months, while necrotic enteritis takes its heaviest toll during the winter months. In all cases where sudden deaths occur, with evidence of septicæmia, it is essential to send a long bone for laboratory examination. Swelling of the joints of the legs is common in erysipelas, but never seen in swine fever or necrotic enteritis. In subacute cases of erysipelas diamond-shaped red or purplish patches are frequently found on the skin. A rough-and-ready method

of diagnosis of cases in which the diamond-shaped patches are not visible, is to scald a pig that has recently died: the patches will then come out, and are plainly visible. In black pigs one can frequently feel the tumefactions when passing the hand over the skin.

In chronic cases gangrene of the skin may be observed. In acute cases, post-mortem examination reveals evidence of septicæmia hæmorrhages which are found on the serous membranes, the spleen is frequently enlarged, reddish-brown in colour, and is often uneven owing to small swellings. The lymphatic glands are swollen and hæmorrhagic. In chronic cases the hæmorrhages are not so pronounced, but a verrucose endocarditis resulting in cauliflower-like growths on the valves of the heart is diagnostic. While anthrax in swine may be subacute, with fever lasting several days, it usually takes the form of a febrile pharyngitis, and in all cases in which swelling of the throat exists, coupled with difficulty in deglutition and respiration, it is essential that as little cutting of the carcase as possible be made, and a microscopic examination be carried out.

HEREDITY IN PIGS.

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Of the larger classes of farm livestock, the pig is the most prolific. Accordingly it is curious that so little is known concerning the genetic qualities of this animal. It is not that little attention has been paid to this question, but that many of the results are inconclusive. This paper is not intended to deal with all the hereditary characters, but only to mention some of those concerning which our present state of information is most definite. References of the authorities quoted are not given, but may be obtained on application to the writers.

Conformation.

Head and Ears.—The cross of the long-snouted Tamworth by breeds with shorter noses give progeny whose face shape is intermediate. There is, however, some American and German work which deals with the long snout found in certain of the wild races of pigs. Here it would appear that the long snout tends to be dominant over the shorter snout and dished face. There is a general uniformity of opinion that the Middle White type of face is recessive. According to Carr-Saunders, the erect ears of the Berkshire are dominant to the lop ears of the Large Black. Actually the dominance is not complete, since the progeny of this cross have somewhat larger ears than their Large Black parents, and the ears also have a slight tendency to lop. The manner of inheritance is probably not a simple one, and according to American investigators is probably determined by at least three pairs of factors. It is interesting to note that Darwin, in his "Animals and Plants under Domestication" (1868), drew attention to the fact that the

pigs of the Orkney Islands had sharp, erect ears, such as we would now associate with the Middle White.

Skin and Hair.—A Roumanian worker, Teodoreanu, has investigated the different types of sebaceous glands, and finds that their location and development varies with the breed. In the Mangalicza and the Berkshire, the body of the gland consists of longish tubules, while in the Lincolnshire and Large Black, these tubules are shorter. The type of bristles and the relative curliness of the hair is also of genetic origin, but the investigations made hitherto cannot be taken as final. On the whole the transmission appears to be intermediate.

By "rose" is meant the whorl of hair sometimes seen on the posterior end of the back above the loin. An American worker (Craft) has examined this character, and obtained evidence which points to this peculiarity being hereditary, and transmitted through both the sire and the dam. The question has also been investigated by Nordby at the Idaho Experiment Station. When both parents were affected, 46 per cent. of the progeny were also affected. From these results he constructed a two-pair factor hypothesis which is probably correct.

Body.—Plaim, from measurements taken from a limited number of pigs of various breeds and crosses, states that on the whole the pelvis is narrowest in the primitive European domestic pig, broader in the curly-haired cross of European and Indian pigs, and broadest in the highly-bred English breeds and their crosses. Constantinescu found the body length of the first cross of the Mangalicza and Middle White Cross to be intermediate between that of the parental types. Ferrin, as a result of work carried out at the Minnesota station, is of the opinion that depth and width of body are pronounced in the early maturing type of pig. Shepperd and others state that from a group of 90 pigs they found 5 had fourteen pairs of ribs, 60 had fifteen pairs, 20 had sixteen pairs, and one had sixteen on one side and seventeen on the other. A more intensive investigation was undertaken by Shaw. From some 4,000 records gathered from many different breeds and their crosses, he obtained a definite degree of correlation between rib number and the "placing" of the carcase. The number of ribs varied from thirteen to seventeen pairs inclusive, and this variation was common to all breeds. There was, however, a distinct breed difference in the number. The larger breeds, especially those of coarse type, appeared to have a greater number of ribs. There seemed to be no connection between sex and rib number. Litter mates showed less variation than unrelated animals. The development of a strain of pigs of uniform rib number should have possibilities, more especially if this character can be relied upon as a sure indication of carcase value.

Production.

Meat Qualities.—Considerable investigation has been made concerning the inheritance of the meat qualities of the pig, both of pork and bacon types. However, the greater part of the work has been concentrated upon the latter. In this country the bacon pig must be of at least 190 lb. liveweight, and should not exceed 220 lb. liveweight. There are certain curers in the Midlands of England

who are able to take pigs of appreciably heavier weights. The great majority of the bacon produced in this country, and practically all the bacon imported from abroad, is from pigs of the Class I group, whose liveweight extends from about 195 lb. to 220 lb. The English are the biggest buyers of pigs in the world market, both in the form of carcases and as cured bacon. Since one object of the Pig Marketing Scheme is to keep out foreign pigs, it is obvious that these are the weights to which the majority of the British pigs should conform.

Quality of the Flesh.—So far as the pig for the English bacon market is concerned, the work of Dr. Hammond, of Cambridge, has, by the examination of the general aspects of meat production, laid a foundation for the genetic investigation of this problem. Anyone making a study of this subject would be well advised to examine his work. Rozycki has carried out slaughter tests, and finds that body length is of the greatest importance in the selection of pigs for the English market. He observed uniformity and thickness of the subcutaneous fat to vary greatly, and the percentage of export material to range from 57 per cent. to 62 per cent. of the liveweight. Two Danish workers—Jesperson and Madsen—emphasised the importance of selection by means of length, more especially as this character is not influenced by environment and nutrition, but is a fixed attribute and of greatest economic value. They obtained a negative correlation between length and the thickness of back fat, and a positive correlation between length and the thickness of the belly. The demand of the market for lean meat tends to make selection by type of equal or even greater importance than selection by breed. The method of grading adopted by the Pig Marketing Scheme deals only with two measurements: the belly must be of at least a certain thickness, while the fat on the shoulder must not exceed a certain thickness. For the next contract period these measurements are, as regards the Grade A pig, as follows:

Class I (from 7–8½ score deadweight)	Thickness of Shoulder fat	Total thickness of belly
Unskinned Pigs (Wiltshire cure) ...	Under 1¾ in.	Over 1½ in.
Skinned pigs (Ayrshire cure)	Under 1½ in.	Over 1⅜ in.

Fargo and Coyner state that the type of pig which makes the most rapid gains produces meat of a better quality and with a higher dressing percentage. Other American work from the Iowa Experiment Station shows that the more rangy types of pigs, such as the Tamworth and the Large White, give a carcase of greater value than the smaller heavier animals. Larsson, of Denmark, also obtained a negative correlation between the degree of fattening and body length, the best animal being the least fat. Some correlation was found to exist between the thickness of the back fat and the thickness of the belly. According to Moskovits, the capacity for flesh-forming is more dependent upon the hereditary disposithan is the case for fat, as flesh appears only during the growing period. With regard to the question of early maturity, we in Edinburgh found that the average of a selected group of pigs from certain of the best herds in Scotland was 200 lb.

liveweight at 229 days old. However, different strains showed considerable variation in liveweight gain: from 0.77 lb. up to nearly 1.05 lb. per day. This represents an age at maturity of from 200 to nearly 400 days.

Economy of Liveweight Gain.—That certain individuals in breeds are better "feeders" than others has long been recognised. In the cost of production of a bacon pig, it is reckoned that the food costs about 75 per cent. of the whole cost of production. Thus any economy in this direction has far-reaching results. Keeping pigs of different hereditary strains under uniform conditions, as has been done in the pig-testing stations throughout the world, demonstrates this point most clearly. Nordby, working on the results of Danish stations, found that the amount of food consumed per lb. of liveweight gain varied, in litter groups of four pigs, from 2.93 lb. to 4.26 lb. According to the testing station, this average varies slightly, but not significantly, and works out at around 3.25 lb. No real difference was obtained between the breeds studied, there being a larger difference found between the strains within the breeds. Beck found that the gilts were superior to the hog pigs. Fargo and Conyer state that such economic pigs produce carcases of better quality.

The Iowa experimenters found that the average amount of food consumed per lb. of liveweight gain varied from 3.5 to 4.6 lb. At the Scottish station we observed a variation from 3.6 to 5.5 lb., with an average of 4.5 lb. We found no difference between pure Large Whites and the cross of Large White and Large Black. Experience showed us that the earlier maturing pigs were the more economical producers. A certain amount of the variation was probably due to the season of the year. During the past three years we have been endeavouring to select at our farm a strain of economical pigs. We have now had several litters whose meal consumption per lb. of liveweight gain was from 2½ to 3 lb. Grimes and Sewall state that for the pure-bred or the almost pure-bred pig, the meal economy of liveweight gain was greater than for the graded or scrub pigs, and as the pigs approached more nearly the pure-breed type, so did the economy of liveweight gain increase.

Pure Breeds.—Several of the pure breeds have been the subject of investigation. But, as already noted in regard to economy of food liveweight gain, the variation between breeds is not so great as the variation which occurs within breeds, and it is more important to pay attention to strain than to breed. There is, however, considerable dispute concerning the value of the cross-bred as compared to the pure-bred pig. For economical meat production, the method adopted by many producers consists of a first-cross between breeds. The same holds good in the case of the pig, and Dr. Hammond is of the opinion that crossing increases the vigour, the size of the offspring and its early maturity. The majority of the investigators are definitely in favour of the cross-bred pig, provided that parents of the pure breeds are of suitable strains. At Iowa, Professor Shearer mated sows both to boars of their own breeds and of other breeds, so that in their litters there were both pure and cross-bred pigs. At birth, the pure-bred was slightly

heavier, but for the period following weaning the cross-bred showed superiority both as regards the rate of gain and economy of food consumption. In a parallel experiment at Illinois, Carrol and Roberts found no significant difference between the pure and the cross bred. Just as there is no particular difference in the first cross between certain breeds of sheep and certain breeds of cattle, so it is to be expected that between certain breeds of pigs the first cross will not manifest this phenomenon of hybrid vigour. On the whole, it may be said that crossing is a sound commercial practice.

Fertility.

The claim of the pig as an economic producer of food rests largely upon the prolificacy of the sow. It must, however, be remembered that the fertility of the sow is conditioned by other than solely genetic factors. The average litter size increases with age up to about the fourth or fifth year, after which there is a decrease. Litter size can also be affected by conditions at the time of mating. Concerning the optimum conditions of mating, there still requires a good deal of work to be done. There is no doubt that the season of the year and the interval between gestations, as well as nutrition, have a definite effect. This by no means implies that size of litter is not conditioned by hereditary factors, but it does mean that under certain conditions environmental causes may mask the genetical ones. It is certainly important to consider prolificacy in the selection of breeding pigs. There is no doubt that the number of mammæ is inherited, and the mode of inheritance is probably independent of litter size. It is important, therefore, that pigs for breeding should have at least fourteen nipples.

Of even greater importance than prolificacy is the mothering ability of the sow. Some sows have an innate tendency to devour their young, and this passion cannot be overcome by nutritional methods. Closely associated with good mothering ability is the question of milking capacity, which is certainly largely conditioned by heredity. The yield of milk is usually higher in sows producing large litters than in sows producing small litters. There is great individual variation in yield. The anterior sections of the mammary gland are more highly productive than the posterior sections. There are also considerable variations regarding the composition of the milk, particularly in the fat content. The question of litter uniformity is probably closely correlated with the quality of the yields of milk from each of the teats. Prolificacy is inherited probably in a straightforward, though perhaps not too simple, manner, with the sire and the dam of equal importance. In the production of a specified litter the boar, if he be normal and in good condition, may have little effect on the number of offspring produced by the sow to which he was mated. As would be expected, he has an effect on the size and type of the litters produced by his daughters.

Defects and Abnormalities.

Of all the domesticated animals, the pig is perhaps the most beset with lethal factors. There is difficulty in determining whether certain of these abnormalities are of genetic origin. There is every reason to believe that a large number of

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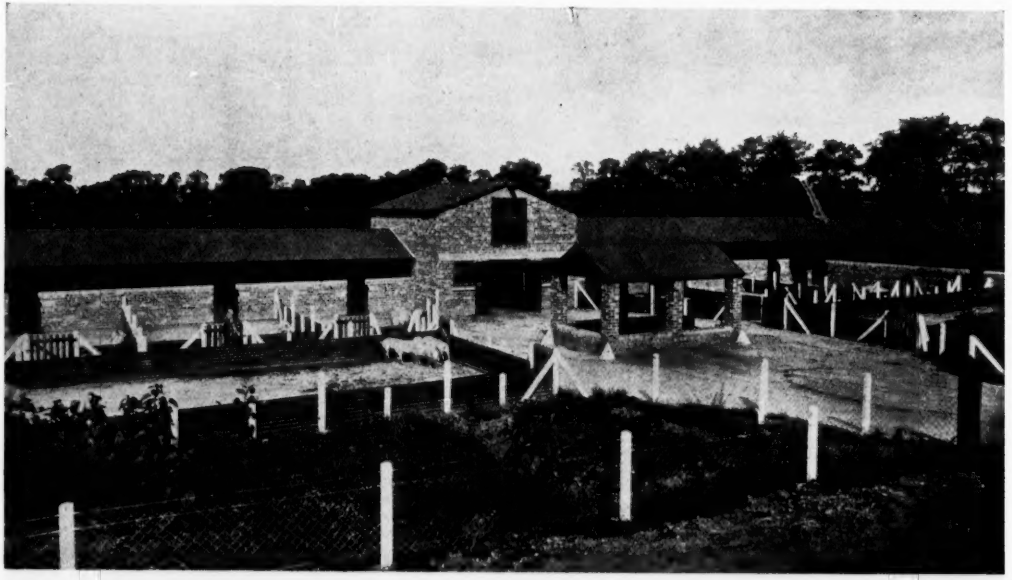
them are due to accidents *in utero*, for it must be remembered that not every fertilised egg produces a live fœtus. Hammond has shown that about 32 per cent. of the fœtuses are resorbed before parturition. Thus certain of these abnormalities may be due to a process of resorption.

Head Defects.—Amongst the most common abnormalities are those relating to the skull and to the skin. Nordby has examined several cases, one of which is of the meningocele and proencephalus type, representing incomplete development of the neural tubes and involving bony investment surrounding the brain, particularly the frontal and parietal bones. This defect is in the nature of a brain hernia on the front part of the skull. He studied over 200 cases which had come to light during an experiment in in-breeding. Sufficient evidence was secured to show that this defect is definitely hereditary, but we are still awaiting full interpretation of the data.

Defects in the external ear may vary from a slight modification of the anterior border to a very pronounced reduction in size. We investigated one such case, but unfortunately complete analysis was prevented in the herd, as it was associated with sterility. Nordby reports similar cases in a famous strain of Duroc-Jerseys. These were traced to an earless dam of a famous show boar. These affected specimens also revealed a number of skull defects. Cleft palate has been observed by McPhee, Schotterer, Koch and Neumüller. Here, again, there is a genetic basis, but the subject has not been pursued to a conclusion. Cleft jaw has also been reported in this country. Certain authorities affirm that blindness in the pig is hereditary. Blindness may range from a complete absence of eyes to deformed eyes. The evidence accumulated at our Institute cannot be taken as definitely indicating a genetic basis. At the moment we have reason to believe that at least certain forms of blindness are due to damage *in utero*.

It is not uncommon for the pig to possess tassels like those of the goat; these are found occasionally in sheep and rarely in man. Their presence is commented upon as early as 1842 by Eudes-Deslongchamp. In their transmission they behave as simple dominant. It is generally recognised that hairlessness is primarily due to malnutrition in the form of iodine deficiency. On the other hand, results of recent work definitely favour a genetic explanation for certain cases where iodine feeding has failed; here the hairless condition is obviously due to genetic causes. Most of the work has been done in America. There would appear to be no doubt that a normal pig, through deficiency in diet, may be hairless. But in other strains, even with a sufficiency of iodine, the pigs will be also hairless. Nordby reports a skin abnormality in the shape of warts. Again the trouble is inherited, but again in no simple manner. Owing to the economic loss involved, since the warts damage the value of the carcase, it is important to remove from the breeding stock any animals suffering from this defect.

Seedy-Cut or Black Belly.—Seedy-cut is due to the presence of black pigment in the glands of the belly when some is present in the skin. The time at which



Experimental Pig Station, Harper Adams Agricultural College, Newport, Shropshire.

(*Article by* K. D. Downham and T. S. Wright, *page* 127)

the pigment appears in the nipple epidermis, and the ability of the epithelial cells to synthesise pigment, controls the presence or absence of pigment in the glands of the black breeds. The ability of the cells to synthesise pigment, and its occurrence, is correlated with the intensity of pigmentation and rapidity of cell division. A Canadian investigator—Deakin—expresses doubt as to the possibility of evolving a strain of pigs which would be entirely free from pigmented glands. From the Wisconsin Agricultural Experiment Station comes further information where seedy-cut has been differentiated into two classes. The first type is that described above, while the second is due to vascular hypertrophy, and may be red, pink or white. The latter type appears in the gland when the gilt reaches maturity, and is red immediately following œstrus, but changes through pink to white during diœstrum. The amount of the seed increases with the number of cycles. Barrows are not affected. No gilt seems to be entirely free from some phase of this skin discoloration.

Scrotal Hernia.—Warwick, of the United States, has shown that scrotal hernia is inherited in a recessive manner, and dependent upon two pairs of genetic factors. The two most common kinds are scrotal or inguinal hernia, and umbilical or navel hernia. The former consists of an enlargement of the scrotum by loops of the bowel. Although the anatomic differences of the sexes limit the occurrence of scrotal hernia to the male, females are occasionally seen which have inguinal hernia in a comparable form. So far as Warwick's investigations go, he has no reason to believe that there is any hereditary relationship between the two. He carried out a series of tests to determine whether scrotal hernia was genetic, and his figures show the probable presence of two pairs of factors acting in a recessive manner.

The pig is an animal which gives rise to a large number of inter-sex forms which have considerable interest for the sex physiologist. Professor Crew has studied this question intensively, and finds a probable genetic basis. Dr. Baker, of Oxford, has examined the occurrence of intersexuality in the pigs of the New Hebrides, and is convinced that this tendency is inherited. There is also confirmatory evidence from Sweden. That veteran German investigator, Dr. Kronacher, who has bred large numbers of pigs, has dealt with the "crit," "shargar," dwarfs, backward and undersized individuals. These are probably the result of genetic causes in that they possess the minimum number of factors necessary for growth and development. He has also reported what we have frequently observed, namely, that genetic factors underlie certain of those cases of pigs which are perfectly normal at birth, but whose development appears to be arrested, or at any rate slowed down considerably, around the age of three months. This is usually associated with certain unthriftiness.

Stringhalt.—Both the Wisconsin and Ohio stations report stringhalt pigs, which walk jerkily with their hind legs. The feet may be jerked as high as the back. A partial recovery may take place after several months. The defect is transmitted by a combination of recessive factors. The occurrence of bent

legs in the Swedish Large White has been fully described by Professor Hallqvist. The legs are stiff and bent at right angles to the longitudinal axis of the body. The animals are usually stillborn, or die very soon after birth. This abnormality has been also reported from Germany, and a similar condition in sheep is known to be genetic.

Syndactyly.—The earliest reference to syndactylous pigs is to be found in Aristotle, and since then many observers have noted this characteristic, which is inherited as simple dominant over a normal hoof. The polydactylous condition is also seen in the pig, where it is usually confined to the forefeet. The difficulty is to distinguish genetical polydactyly from that represented by teratological phenomena, and which are mainly caused by disturbances of the amnion during development. The condition is probably a Mendelian dominant. Matings between syndactylous and polydactylous pigs produce offspring the majority of which are either polydactylous or polydactylous and syndactylous combined. Of the remainder, a few may be syndactylous and a few normal. Schotterer has observed that the polydactylous condition is occasionally accompanied by the condition of cleft palate. There is no evidence that the syndactylous condition is associated with any special resistance to disease, despite claims made to the contrary.

Disease Resistance.

The work at Iowa and Illinois has definitely shown that certain pigs possess a high degree of resistance to hog cholera or swine plague, and that this resistance is transmitted from one generation to another. By selection, pigs have been obtained with a higher degree of resistance than that possessed by any of their ancestors. It is unlikely, however, that it will be possible to obtain a strain immune to this disease. The work is interesting, but complicated owing to the difficulty of standardising methods of infection.

Colour.

Deliberately the question of colour has been left to the end. With most of our domesticated animals this is the character the mode of whose inheritance is most clearly understood. Such cannot be said of the pig, and the whole question has recently been thrown into the melting pot by the series of investigations of Kosswig and Ossent. Rather than describe the various theories we propose to outline briefly the colours usually obtained in the first cross progeny from different pairs of British breeds.

Large White × *Large Black* gives as a rule progeny that are white with blue spots, *i.e.*, black spots on the skin, but no black hairs. Occasionally these spots are black, in which case the skin and the hair of the spot are both black. This cross always has either black or blue spots. Occasionally the black spots are so extended as to give the appearance of a black pig with white marking. Such pigs, *e.g.*, the Berkshire, are not black pigs, but rather white pigs with black markings.

Middle White × *Large Black*, the same as above, but the frequency with which black spotted pigs appear as compared to blue spotted is increased.

Large White × *Berkshire.*—The progeny of this cross are usually white pigs without blue or black markings.

Large White × *Tamworth.*—The progeny are, as a rule, all white with a few red hairs or a general reddish tinge in the hairs.

Large Black × *Tamworth.*—This cross gives red pigs with black spots. The spots are usually small. Mr. Theo. Stephens, the well-known agricultural journalist, used to have success at Smithfield with this attractive cross. Occasionally red pigs result from this cross.

Berkshire × *Tamworth* also gives the same results, though it is interesting to note that the Germans, who made this cross, describe the result as black with red spots.

In Britain the colours of our pigs are restricted, but from other parts of the world the pigs are to be found of many colours, amongst which are wild (Agouti) grey or grey-black, sepia, sapphire (blue roan) and roan. Up till now the albino pig has not yet been discovered. Albino horses and cattle have been heard of, but we have yet to see an albino pig or an albino sheep.

In conclusion, we would like to note that many of the investigators whose names we have quoted are veterinary surgeons. A great deal of information has been supplied by members of the veterinary profession. The young pig, being one of many, there is a tendency for the agriculturist to knock an abnormal one on the head and think no more about it. This is of frequent occurrence, and that it has not been the case universally is mainly due to the veterinary practitioner.

SOME PREVENTABLE DISEASES OF PIGS.

By K. D. DOWNHAM, *Head of the Veterinary Department*
AND
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Ascariasis or Round Worm Infestation.—Although the pig is subject to over fifty different species of worms, the nematode, or round worm, *Ascaris lumbricoides* (*suilla*) is the most important. It has been estimated that nearly 50 per cent. of the losses in young pigs is directly or indirectly due to infestations of this parasite. The worm is about 6–12 inches in length and from 3–5 mm. thick. It is whitish in colour, possesses three well-defined lips, and both the male and female inhabit the intestines, whence they sometimes migrate to the stomach or bile ducts of the pig, causing gastritis and jaundice. They have even been found in the eustachian tube in exceptional cases. The eggs are oval, possess a thick shell, measuring about 0.06 × 0.05 mm., and are passed in the fæces.

The ova are not infective immediately after they leave the animal, but reach the infective stage some weeks after lying on the ground. They are extremely resistant to climatic conditions and to disinfectant solutions, and can remain dormant for years on the ground, and still be capable of developing into adult worms if ingested by pigs. When eaten the eggs hatch in the small intestine, and the larvæ burrow into the intestinal walls, and reach the blood and lymph stream, whence they are conveyed to the liver. From the liver they travel to the heart, and thence to the lungs by way of the pulmonary arteries. In the lungs they develop, escape from the lung capillaries into the alveoli, and often cause parasitic bronchitis and pneumonia, which is so commonly met with in young pigs. The larvæ are coughed up from the lungs into the mouth and are again swallowed ; they reach the intestines a second time, and there they develop into adults. The females produce thousands of eggs, which are passed with the fæces. Yoshida has observed that it is also possible for the larvæ to pass through the intestinal walls into the abdominal cavity, and then penetrate the liver, in addition to their ramifications by way of the blood and lymph stream. In the management of pigs it is found that very few animals are free from these parasites when they attain the age of a few weeks. The effects of this infestation are delayed marketing, increased food costs, retarded development and general unthriftiness, digestive and respiratory disorders which frequently result in death. The soft and greasy fat of pig carcases, which is a cause of annoyance to consumers and curers, is also no doubt often the indirect result of ascarid infestation due to a check in development of the pig.

In practice it is found to be economically sound to treat young pigs regularly for worms. Mass dosage with Santonin is probably the most popular method adopted by farmers, many of whom omit to dose altogether through the lack of knowledge of the loss they experience due to this cause. The disadvantages of this form of treatment are obvious, for the drug is not only diluted and unevenly distributed, but the most heavily infested pigs frequently receive little or none of the mixture owing to their weak condition or from want of perseverance in procuring food due to their debilitated state. Individual dosage, though more costly in labour, is infinitely more successful and worth while than mass dosing. Two men, one catching and holding the pig, and the other dosing, can easily dose one pig per minute with the aid of a gag. Ol. chenopodium is an effective and fairly cheap drug to use, and is recommended for this purpose. The drug should be administered after starving the animal for some hours, and should be followed by a purgative, such as calomel or magnesium sulphate, and repeated two or three times.

The McLean County system, where the sows are dosed for worms two or three times before farrowing and their udders washed before admission to the clean farrowing pen, the young pigs being moved to mechanically clean pens every three weeks, gives excellent results. By this means worm eggs are not picked up in the infective stage, and the unresistant tissues of the young pigs are not subjected to infestation during their most susceptible period.

Tuberculosis of Pigs.—This is most commonly met with in dairying districts where the practice of feeding milk products to pigs is adopted. In this country the type of tuberculosis which predominates in pigs is that caused by the bovine strain of tubercle bacilli. The Royal Commission upon Tuberculosis reported upon 59 cases of tuberculosis in swine, and found the bovine type in 50 cases, the avian in five, the human in three, and a mixed type of bovine and avian in one case. Griffith and Eastwood also found the bovine type to predominate after examining a series of 77 cases of tuberculosis in pigs. In America,* where the incidence of tuberculosis in cattle is very low in comparison to this country, the type of tubercle bacilli which is responsible for 75 per cent. of the tuberculosis in pigs is the avian type.

The writers are aware of instances where hogs of the same age and weight were divided into groups and fed alike, except that one group had a proportion of skim milk added to their diet and the other had no milk. On slaughter it was found that the groups which had received meal only were free from tuberculosis, whilst the groups which had received milk as part of their ration included a number of animals which were affected with tuberculosis.

Many farmers are alive to the fact that milk products fed to pigs are often responsible for tuberculosis, and adopt the practice of selling such pigs in the open market alive, disposing of meal-fed pigs only on a dead weight basis.

If the Milk and Pig Marketing Schemes are to be successful, there is every indication that eventually each must assist the other by the consumption of separated milk and whey by pigs (especially by young stores) in a similar manner to the means employed by New Zealand and Continental countries. Should this probability come about, the problem of eradication of tuberculosis in cattle will become of even greater urgency to agriculture than it is at present. If the public health aspect is ignored entirely, it is obvious that, from the point of view of co-operation with the pig and milk industries, the sooner the herds of the country are cleaned up the better, if the one is to aid the other with any economic degree of security.

Anæmia.—The old saying, "prevention is better than cure," applies particularly to anæmia in young pigs. It is a preventable condition, and can be effected without cost, by allowing sows and their litters access to clean pasture land from the time the young pigs are ten days old until weaned. This practice is not new, but it is only recently that its significance in successful pig rearing has been appreciated. It provides the essential factors which are necessary to produce the hæmatinic element which the pig in confined styes is often unable to obtain. In addition to ultra-violet rays absorbed by the skin, the pig is able to obtain the animal, vegetable and mineral matter from the turf amongst which it roots. The exercise afforded by this system of pig rearing is beneficial for the promotion of appetite and the stimulation of the respiratory and circulatory systems. In the warm sty young pigs spend a considerable part of their time sleeping

* T. C. Hull: "Diseases Transmitted from Animals to Man," 1930, p. 25.

head to head under the straw, with the result that the carbon dioxide content of the blood increases and full use is not made of the lungs. Post-mortem examination of pigs a day or two old often reveals that parts of the lungs have never functioned properly. This condition may be prevented if the animals are forced to go out into the open, where they will run about, distend their lungs fully, and oxygenate their blood satisfactorily.

In our experience the simple method of allowing the sows and their litters access to pasture land during the day has cured pigs that have already become anæmic in buildings on many occasions. Ashes and cut turves are often recommended to be given in the sties, and are better than nothing, but for successful treatment, a run out of doors, even for only one hour per day, is desirable.

Curative treatment by drugs has met with a certain measure of success in cases where only one or two litters have to be treated, and where the owner is his own stockman, but it is hardly practicable to dose individual pigs daily where large numbers are kept. The drugs recommended are syr. ferri phosph. comp. (Parrish's Food) in 1 drachm doses for two or three days, or ferri carb. sacc., grains 3 to 6; ferri. ammon. cit., grains 3 to 6. Reduced iron in small doses is also of value.

REARING YOUNG PIGS.

By V. C. FISHWICK.

Pig Husbandry Research Station, Wye College.

Success in rearing young pigs is the foundation of profitable pig-keeping. Unfortunately the rearing of young pigs is by no means a simple business, and whilst some pig-keepers are consistently successful, there are many herds in which not only is the mortality unduly high, but the condition of the pigs which survive to the time of weaning is poor. The fact is that in the past the rearing of young pigs has been looked upon as an art—an art in which some pig keepers have acquired considerable skill, but which many have failed to master. The subject has been studied systematically at Wye during the past five years. It is a problem bristling with difficulties because of the numerous factors involved, several of which react upon one another; but although the investigation is in its infancy, it is possible to see the nature of some of the major factors involved from the data obtained to date.

The popular explanation of the death of sucking pigs is that "they are laid on." The explanation is undoubtedly usually correct, but the writer's observations made on over three hundred litters lead him to suggest that the reason why by far the greater proportion of the pigs get laid on is that they are below par, and in consequence sluggish, making little or no attempt to get out of the sow's way. A normal healthy pig quickly learns to keep out of the way of its dam. A few healthy pigs do get killed during the first twenty-four hours after farrowing,

but even those pigs nursed by a clumsy sow quickly learn to look after themselves as long as they remain healthy and retain their vigour. Thus when the mortality amongst young pigs is unduly high it generally indicates that something is wrong, *e.g.*, that feeding or management is faulty, or that disease is active. The object of this article is to discuss a few of what, in view of the data at present at the writer's disposal, appear to be the salient points in management and feeding.

The Selection of Breeding Stock.

The first essential is prolific sows, which have the capacity for producing large quantities of milk and rearing their pigs well, mated to suitable boars. It is impossible to produce first-class litters from indifferent breeding stock by any system of feeding and management, but very indifferent results are frequently obtained from first-class breeding stock as the result of faulty feeding and management.

Management.

(1) *Systems of Management.*—For our present purposes it will be sufficient if we consider that there are two systems of management of pigs: (1) The open-air system; and (2) the sty system.

Under the open-air system, the pigs are allowed free range over pasture land or arable crops. There are two methods of doing this: (*a*) The pigs are allowed to have the run of a field, a system which is very efficient with small numbers, but has the disadvantage that the different lots cannot be kept apart and that the pigs must be run in comparatively large lots. It is not a very practicable system for large herds. (*b*) The pigs are kept in small runs, each of which is provided with a shelter. This system is comparatively efficient so long as the ground is kept free from parasitic worms by moving the runs on to fresh ground periodically. Unfortunately it has several disadvantages: (1) The labour involved in moving the runs is excessive; (2) pigs are not really good graziers, and it is difficult to regulate the stocking of the pen: as a result at times the pigs are short of grass, whilst there are other times when the grass grows away from them; (3) the land gets very badly trodden in wet weather, and considerable areas are frequently completely denuded of their herbage. When pigs are kept upon the out-door system, it is essential to ring them unless there is no objection to the ground being rooted up.

There appears to be ample justification for the statement that "in-pig sows will produce better litters if kept upon the open-air system until within two or three weeks of farrowing." The result obtained at Wye indicate that it is much easier to rear young pigs on the open-air system than it is those which are confined to sties. The former develop a better appetite, and suffer less from scour and other ailments than do the latter.

(2) *Accommodation for Pregnant Sows.*—When a number of pregnant sows lie together, it is essential that adequate floor space be provided, and as a rule it

should all be in one building. The writer has seen sows lying one on top of another in one hut, whilst a few yards away an empty hut was available. It is an advantage if the building in which a number of pregnant sows are housed has a wide door : two sows attempting to get out of a narrow door may easily cause farrowing troubles.

(3) *The Farrowing Pen.*—The floor of the farrowing pen should be impervious and free from holes. Young pigs are very liable to find it difficult to get out of a hole quickly, a very essential thing when the sow lies down, thus holes in the flooring are a death trap to young piglets. It is an advantage to give the sow a good bed of straw cut into short lengths. The practice of allowing sows to farrow and rear their pigs without litter may be regarded as bad, because the young pigs rub their knees and frequently other parts of their bodies on the hard floor, causing abrasions. The use of long straw is objectionable for two reasons : (1) Long straw impedes the movements of young pigs, and thus increases their difficulty of keeping out of the way of their dam ; (2) the navel cord takes several hours to shrivel up, and before it does so the young pig has four to five inches of cord hanging from its belly which is very liable to get tangled up in long straw. If the sow gives a sharp movement and knocks the pig over while the cord is entangled in the straw, it is liable to get torn close to the body ; the pig then bleeds, and, losing vigour, becomes sluggish and probably gets laid on.

(4) *Removing Teeth of Young Pigs.*—A simple problem occurs in connection with the teeth within about twenty-four hours of farrowing. During this period the young pigs usually fight fiercely for the teats, and, having sharp teeth, cause wounds on the cheeks and ears of their litter mates, which speedily get covered with unsightly sores. Removal of the teeth at birth is sometimes advocated as a means of obviating this damage. In the process, however, the gums are usually badly damaged, and jagged stumps are left which cause wounds on the inside of the lips. The wounds to the gums and lips are more serious and difficult to treat than the external wounds caused in fighting: the latter readily respond to simple treatment with a tincture of iodine. It would not therefore appear to be desirable to remove the teeth unless they are abnormally long and as a result the sow gets sore teats. Pigmen should always keep a sharp look out for sore teats, a trouble which is liable to occur if the teeth get too long at any time during the nursing period. When it occurs there is nothing for it but to remove or break off the teeth of the pig or pigs responsible for causing the trouble, but the operation should be done with care, using the proper instrument, and it is wise to take the precaution of dressing the gums with a tincture of iodine.

(5) *Attention at the Time of Farrowing.*—The presence of a pigman who has gained the confidence of his sows at the time of farrowing will save on the average one pig in every two normal farrowings, and may save a very large proportion of the pigs when a restless sow farrows. A man who does not know his job will do more harm than good.

Feeding.

Table I gives the weekly weight of a normal litter of ten pigs, which may be taken as an example of a comparatively good litter of this size.

TABLE I.

Age.	Weight.	Weekly Gain.
24 hours	36¾ lb.	
1 week	60 ,,	23¾ lb.
2 weeks	91½ ,,	31½ ,,
3 ,,	119 ,,	27½ ,,
4 ,,	127 ,,	8 ,, (suffering from scour when weighed)
5 ,,	158½ ,,	31½ ,,
6 ,,	195½ ,,	37 ,,
7 ,,	242½ ,,	47 ,,
8 ,,	300 ,,	57½ ,,

It will be seen that the above litter weighed over 30 lb. at birth, that is to say that during the gestation period the dam was producing an average live-weight increase of a quarter of a pound per day in the form of pigs, the daily growth of the pigs being small at the beginning and larger towards the end of the period. In addition, udder development increases towards the end of gestation period. Thus it is obvious that the pregnant sow requires a small amount of protein in the ration, and that the protein content of the ration towards the end of the gestation period may easily be a major factor in the development of the litter. The writer estimates that the average protein intake during the gestation period should be approximately three-quarters of a pound per day, and his observations appear to indicate that the amount may be raised to about one and a quarter pounds per head per day during the last two or three weeks with advantage.

Sows which have free range on good grass land during the summer months frequently produce satisfactory litters when fed on badly balanced rations, but if sows which cannot obtain an unlimited amount of good grass or other suitable forage crop are fed on ill-balanced rations, such as cereal meals with a low protein content, or potatoes, they appear to be liable to produce badly matured pigs. The writer has had under observation sows upon ill-balanced feeding in which the greater portion of the pigs have died at, or shortly after, birth. The feeding of in-pig sows in the Wye research herd is as follows: (1) When plenty of grass is available, between two and four pounds per head per day of a mixture containing 5 per cent. of fish meal; (2) when there is little or no grass available, four to six pounds per head per day of a mixture containing 10 per cent. of fish meal. The sows have free range on pasture. Between two and three weeks before the sows are due to farrow, they are brought into the farrowing pen, and they subsequently receive the ration which is to be fed to them during the nursing period. The quantity of food fed is raised slightly, but no definite standard is followed: if the

sows are poor they are fed liberally, whilst if their condition is good the quantity is restricted. Throughout the gestation period the quantity of food is regulated in accordance with the amount of keep available and the condition of the sows. We aim at keeping them " in good store condition," *e.g.*, neither fat nor very poor.

It is almost universally admitted that the feeding of the nursing sow is one of the primary factors connected with the rearing of young pigs, but opinions of pig breeders differ in a surprising way regarding what are obviously essential features. Many breeders feed their sows comparatively lightly during the first month of the nursing period, stating that heavy feeding is liable to force too much milk, and cause the young pigs to scour. There are others who state that the use of concentrated protein feeds such as fish meal in the ration will produce the same result. These ideas appear to be fundamentally wrong. Reference to Table I shows that the litter from which figures are given increased in weight at the rate of three pounds per day during the first week of its life, and at the rate of four pounds per day during the second and third weeks. The sow has no reserve of protein upon which she can draw, and it is obvious that she must be liberally fed and receive a highly concentrated ration if she is to produce the milk which is necessary to enable her pigs to grow at such a rate.

At Wye the quantity of food is only restricted in the case of those sows which are nursing seven pigs or less; with litters of eight or more pigs the best results so far obtained have been given by sows which from the third day after farrowing received all they would clear up readily (not all they would eat) twice a day of a ration containing between 16 per cent. and 17 per cent. of digestible protein. The cereal meals normally used in pig feeding contain only a small amount of protein, and in order to obtain a mixture with such a high protein content it is necessary to add to them 10–12 per cent. of one or more of the highly concentrated protein feeds. Sows fed in this way have been observed to be eating their maximum daily ration (14–16 pounds per head per day) when their pigs were between two and three weeks old. It is desirable to allow them some exercise to keep their digestive system working normally, so they are allowed out twice a day. For a few days after farrowing they will only leave their pigs for a few minutes, but the time can be lengthened gradually each day, until about three weeks after farrowing they remain out for between one and two hours. They go out into a field adjoining the buildings.

Turning now to the young pigs for the first three weeks, they are entirely dependent upon the milk of their dam. They should commence to eat supplementary food when between three and five weeks old. The degree of success attained in rearing a litter depends very largely upon the young pigs starting to eat at this period. Litters having free range over grass land almost invariably do so, but those confined to sties frequently show less inclination to eat supplementary food, and no pains should be spared to get them to do so. Some young pigs show a preference for dry meal, others for meal which has been soaked;

whilst in cold weather it is sometimes helpful to offer them warm food. There are several devices which the pigman can use to tempt the young pig to eat, but the dominant factor appears to be the appetite of the pig. Young pigs which are well nurtured by their dams almost invariably take readily to supplementary food. On the other hand, weakly, badly-nourished pigs frequently show no tendency to eat meal. The Wye method is to have a creep railed off in one corner of the sty behind which a low trough containing a small amount of food is continually kept immediately the young pigs show any interest in meal. For a few days they eat only a small quantity, but when about five weeks old, sometimes earlier, they begin to eat appreciable amounts, and they are subsequently rationed, being given all they will clear up readily twice (or better, three times) per day. This is desirable, because when the young pig has taken to supplementary food it is liable to overeat, and thus upset its digestive system if not rationed. Pigs which do not take to supplementary food when they are about five weeks old are very difficult to rear. In most cases a deterioration in the condition of the young pig sets in if they are not eating supplementary food at that age, and continues progressively until they do start to eat.

Scour.

This term has been rather loosely used in recent years, and there are some who look upon scour as a disease. The more generally accepted use is here made of the term, *e.g.*, as describing a symptom which is characteristic of a number of disorders. Every litter which has been reared at Wye has been observed to scour at some time during the nursing period. The litters may be divided into three groups, as follows: (1) Those in which the disorder has disappeared after one, two, or three days without treatment; (2) those in which the disorder has shown a tendency to persist, but has yielded to treatment; (3) those in which, in spite of treatment, the disorder has persisted until the young pigs have either commenced to eat supplementary food or died.

In the majority of cases the excreta has been white in colour, but a limited number have been observed in which the colour of the excreta was (1) brown, (2) orange, (3) grey, in colour. A few litters have been affected by scour during the first three weeks of their lives, but in by far the greater majority the trouble has occurred when the young pigs were between three and five weeks old. Only in a very limited number of cases has the disorder been observed to occur amongst litters which were eating any appreciable quantity of supplementary food, and in the majority of these it has apparently been directly or indirectly due to overfeeding. The litter for which figures were given in Table I was scouring when the fourth weekly weighing was taken. The disorder lasted for three days. It will be seen that the growth rate received a serious check; in many litters the growth rate is checked for two or three weeks, and if the disorder persists for long, the young pigs suffer serious loss of condition.

In the Wye herd, amongst pigs which have been reared on the open-air system

we have had very few cases in which scour has not disappeared without treatment. *It has been amongst those pigs which have been confined to sties* that the disorder has been most troublesome, and in very few cases has it disappeared unless suitable treatment has been applied. The simplest and most effective method of treatment so far discovered has been to keep a careful look out for the appearance of scour in every litter. As soon as any sign of scour is seen the sow and her litter are turned out on to a clean grass enclosure for two or three hours every day until the litter is sound. In most cases the disorder has disappeared in about three days, but in some it has been necessary to turn the affected litter out for six or seven days before the disorder completely disappeared. This method of treatment has been in use for six months, during which time thirty-one litters have been treated; in twenty-eight of which the method has been completely successful.

Dosing of pigs individually with lime water or sulphate of iron, and placing ashes, earth or turf at their disposal, have been tried, but appear less effective than the method outlined above.

The writer's observations indicate that scour is comparatively easy to control in well-grown, well-nourished pigs; but that it is often persistent, and does not respond readily to treatment when it occurs in undergrown, badly-nourished pigs.

We have observed a correlation between the incidence of thundery weather and hot sultry weather and outbreaks of scour. In every case in which we have had young pigs between the ages of three and five weeks during the summer, when hot, thundery weather has occurred, the incidence of these conditions has been followed by an outbreak of scour. In those cases in which the period of oppressive weather has been of short duration the scour has disappeared when the temperature fell, whilst if the weather has remained hot and close for several days it has been necessary to apply treatment to check the disorder.

In conclusion, it may be pointed out that although this investigation is in its infancy, the knowledge gained to date has enabled us to make considerable improvements in our methods. Five years ago, 20 per cent. of the pigs reared in styes were lost, and the condition of those which survived was poor, although it compared quite favourably with that of young pigs reared on many commercial farms. During the past twelve months, from sows of the same breeding, over 90 per cent. of the pigs born alive have been reared. The pigs reared during the past six months have had the condition and " bloom " which is usually associated with milk feeding, though we have not used any milk.

The writer desires to take this opportunity of acknowledging the help received from the Veterinary Research Department of this College. They have made all the necessary post-mortem examinations, and not only has their treatment of such cases of disease as have occurred enabled us to maintain a very high standard of health in the herd, but on numerous occasions they have greatly assisted with helpful practical advice.

XUM

Clinical Articles

Anæmic Pigs.

By G. MAYALL, M.R.C.V.S.

It can hardly be expected that where sows are not fed properly during the period of pregnancy that strong, robust and adequately blooded progeny will be produced. The treatment of anæmic litters may be satisfactory or otherwise, but unless some advice is given as to the feeding of the sow, so that at the next pregnancy weak and bloodless progeny may be avoided, the best steps to escape anæmia would seem not to have been taken. We all know how indifferently, in many cases, the sow is fed during her period of pregnancy. As long as she produces ten or a dozen piglets, matters seem to be *couleur de rose* in the eyes of her owner. Corn and vegetable food obtained when grazing perhaps produce the best results. Sharps may be given a week before pigging. The general swill tub from which a supply of liquid food is taken to all pregnant sows is, to my mind, an objectionable utensil as it is often managed. Sometimes it never gets cleaned from one year's end to another, and the contents of the tub may vary almost daily in nutritive principles. Roots must always be given sparingly, and especially so as the time of farrowing approaches. Summer rations for breeding sows of average size should approximate the following: Barley meal, 2 lb.; bran, 1 lb.; green clover, 12 lb.; wash, 18 lb. Winter rations, such as potatoes, 6 lb.; carrots, 1 lb.; barley meal, 1 lb.; and wash, 18 lb. Years ago Mr. James Long, Professor of Dairy Farming in the Royal Agricultural College, addressed the following question to some of the principal pig breeders in England and America: *What do you consider the best food for an in-pig sow?* The answers are worth noting as coming from well-known pig-breeders of large and extended experience.

Mr. James Howard, M.P., said: "Dry corn or bran with a few raw mangels, turnips or potatoes as the sow approaches farrowing, as the young are almost certain to be born dead if the mangels are freely given." Mr. Sanders Spencer said: "Vegetable food with a little corn, beans, peas or maize until within a week of farrowing, when randan should be substituted." Colonel Platt: "Steamed Indian meal and a little sharps mixed with water." (Not good in the writer's opinion—G.M.). Mr. Benjafield: "I prefer a good grass run with bran, barley meal and grains." Colonel Walker-Jones prefers "crushed wheat, potatoes, swill and bran scalded." Mr. James Robertson gives mangels, grass, whey, skim milk and sharps. Mr. Frederick Coate says: "In-pig sows should not be in too high condition. Mine always do well on grass during the day, with a few beans, peas or any dry corn, and a swede or two morning and evening." Mr. W. Ellsworth, of Woodstock, Illinois, prefers grass with a little maize, or if confined to a yard, a mixture of oats, corn and shorts.

It will be noticed that six out of eight of these gentlemen recommend corn of one kind or another in the feeding of pregnant sows, and we think some amount of it is necessary if good strong, healthy litters are to be produced. It will be observed also that five out of eight gentlemen recommend grass or vegetation. Iron and manganese aid respiration and oxygenation, and it is important that sows especially should have some greenstuff in their diet. Iron and manganese are most abundant in grass and plant life during their period of growth, and many present-day rations for pregnant sows are deficient in these minerals. It would seem also that exercise is necessary for in-pig sows, as movement in the air aids respiration, digestion and circulation. In our country it appears as if a modicum of corn is always beneficial. The weather here is more rigorous and changeable than in France, where Monsieur Ayraud, a noted French breeder, gives the following rations as an example of daily food for a pregnant sow weighing about 220 lb.: Cooked potatoes, about 2½ lb.; cabbages, carrots or turnips, 6½ lb.; buttermilk, 13 lb.; bran, 2 lb.

The Ministry of Agriculture leaflet No. 104 states that "pigs, especially when sty-fed, should be supplied with minerals, cinders and green food, and pigs fed in the open should always have access to water." We heartily agree with these statements.

According to Adsersen in an article in *Deuts. Tierarztl. Wschr.*, Vol. 39, pp. 741–745, on "Anæmia of Young Pigs and its Significance as a Cause of Death," the giving of 2 per cent. sulphate of iron solution in teaspoonful doses to anæmic piglets did not increase the amount of iron in the blood during the suckling period, but it did enable many of the young pigs to survive until the weaning period, whereas far more of the others that did not have the iron solution died. *Query*: Did the iron solution save the life of the little pigs by its antiseptic and disinfectant action on the digestive organs and their contents?

Literature: "The Book of the Pig." 2nd edition. By James Long.

Tumours of the Mammary Gland and Their Removal.

By R. HUDSON, F.R.C.V.S.
Retford.

THESE tumours may be single or multiple, small, or reach to a large size, and are often ulcerating. They are said to be frequently actinomycolic, sometimes tuberculous, and they may be, at the onset, of simple mastitic origin. They may develop at the beginning of lactation, or after weaning time. They develop with considerable rapidity as a rule. If seen early and lanced they are found to contain a mucus-like material, the liberation of which is not always satisfactory owing to secondary infection of the cavity. The opening granulates freely and often develops into an ugly sore, while the tumour goes on increasing. Sometimes they burst naturally, and then they always result in a nasty discharging mass. At one time I was tempted to remove them by proper surgical procedure, but

found it was not as easy or as satisfactory as it should have been. They are very vascular, and hæmorrhage takes a lot of dealing with ; also removal with the knife may be productive of shock, and the animal may die quickly, as in removal of the uterus after prolapse.

The sutured wound often does badly owing to contamination with filth. Ligation is much the easiest and most satisfactory way of removal. It can be done standing, the animal being tied up by the snout, or better when cast and tied, as a colt, with side lines. The ligature should be strong enough to bear a man pulling at each end. It should be tied on a single knot at each half-turn round the neck of the tumour until, after passing round three or four times, it is finally secured. The clove hitch fails to pull up tight enough. If tied sufficiently tight the mass falls off in five or six days. A strong solution of creolin should be poured over the ligature, and afterwards applied daily to the wound. The ligature does not appear to cause pain, but it is advisable to inject in three or four places round the neck of the tumour a 5 per cent. solution of cocaine.

Swine Erysipelas.

By R. HUDSON, F.R.C.V.S.
Retford.

THE occurrence of swine erysipelas a few days before, or immediately after, farrowing is not uncommon. It is usually of the acute type, with absence of spots, and is marked by high fever, blue-red coloration along the abdomen and inside of the legs. The colour of the rest of the body tends to brown or copper colour. The pig is usually prostrate or difficult to rouse, and moves stiffly when she is up. Such cases I have treated successfully with 20 c.c. of serum daily, along with 10 c.c. tincture camphor, 1 in 10, hypodermically ; magnesium sulphate, four to six ounces in a gallon of tepid water, is injected daily per rectum, partly to empty it, and partly to promote action of the intestines. If they take food, potassium nitrate, half to one ounce daily, is given in about one and a-half gallons of bran water strained through sacking. Only bran water is allowed. The patient should be kept as warm as possible, being smothered in straw. If there is a litter, they should be penned in a corner, and given the bottle (diluted milk and treacle) for a few days. During last summer four cases—one before, and three after farrowing—recovered, and most of the pigs were reared. One sow, with a litter of twelve pigs, lay prostrated for three days, and then recovered, and the owner managed to rear the whole of the litter, helped by the sow as she recovered.

Siamese Twin Piglets.

By JOHN D. PEELE, M.R.C.V.S.
Durham.

THE subject of the photograph was born on February 23rd, 1934. The dam was a Cumberland sow, and this was her second litter. In the first litter she

had nine, all of which died, the owner stating that the sow was ailing, and that the piglets were starved. On this occasion the sow had three pigs without difficulty, and then, after straining hard for about an hour, passed the twins. She was up to time, and both she and the remaining three piglets are well and healthy. The twins lived for an hour and were then destroyed.

THE HISTORY OF CHLORODYNE.

EVERY member of the veterinary profession knows of Chlorodyne, and it is not only amongst our animal patients that its "pepperminty" and warming taste has a passing acquaintance, for the position of this popular bottle on the dispensary shelf is as well known to the wife of the veterinarian as it is to the owner of the practice himself. How few, however, of those who have used it, either on themselves or their patients, know aught of its origin or its family history.

The originator of the formula, Dr. John Collis Browne, was an Army surgeon, who used the preparation with remarkable success in 1846, in the treatment of cholera in India, and at a later date in the cholera epidemic in Great Britain in 1853–54; whilst during the Crimean war its early use saved thousands of lives. So efficient was it found to be that Dr. Browne secured a business partner in no less an authority than Mr. J. T. Davenport, Ph.C., a Vice-President and subsequently President of the Pharmaceutical Society; and in 1902 the production of this valuable preparation was entrusted to a private company (Messrs. J. T. Davenport, Ltd., of 87, Union Street, S.E.1), in whose hands it still remains. One member of this firm (Mr. Horace Davenport, Ph.C.) has become well known to the sporting world as the Amateur Swimming Champion of Great Britain. It passed triumphantly as an absolutely essential medicine for the medical chest in the Boer war, as well as every little punitive expedition down to the time of the "Great Calamity"; and since then its popularity has again acclaimed it to be a medicine which is not only essential to be kept handy for immediate use in every household, but equally so in every stable, kennel (or even piggery and cattery) where animals of all ages and breeds require that little "stitch in time" which may truthfully and literally "save nine." It usually appears to be the Safeguard to use to "keep things going" until the arrival of the skilled practitioner and diagnostician.

WE have just received a price list from Messrs. Wyleys, Ltd., of Coventry, Manufacturing and Analytical Chemists. All readers will know this old-established house, and those who have not already received their catalogue should write for one. In it will be found many old and trusted preparations, together with a lot of new ones. One of their best-known products is the Duraplastic Coated Horse Ball. A private formula can be used if desired, and arrangements can be made to have the name of the veterinary surgeon upon each Ball, if orders of not less than two gross are placed. Another interesting line is their Antiseptic Dressings and Bandages, which can be recommended with confidence.

1402

THE BACON PIG

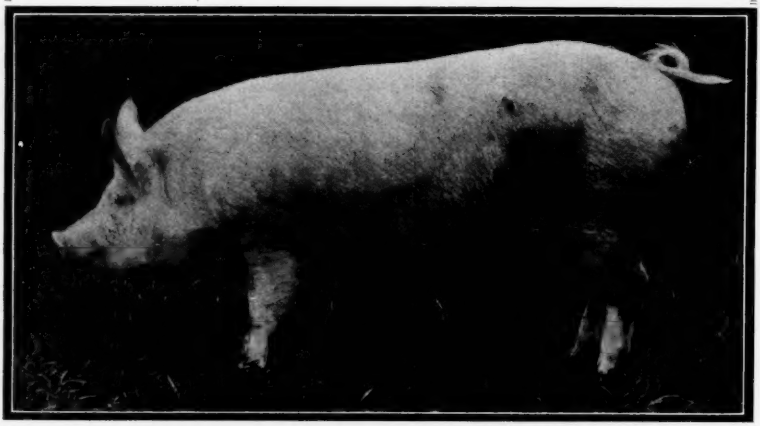
BY

THE EARL OF RADNOR, William Reginald Bouverie
Late Chairman of the Pig Industry Council; Member of the Pig Marketing Board

VETERINARY JOURNAL SUPPLEMENT
MARCH, 1934

LONDON:
7 & 8, HENRIETTA STREET, COVENT GARDEN, W.C. 2

RIGHT TYPE OF BACON PIG



"Farmer & Stockbreeder" Photograph

THE IDEAL BACON PIG

(From the Ministry of Agriculture Pig-Keeping Bulletin)

BACON

HEAD, NECK AND JOWL: Light.

SHOULDERS: Light and on a line with the forelegs below and with sides laterally. Free from wrinkles and coarseness.

BACK: Long and level with ribs well sprung.

BELLY AND FLANK: Thick, with straight underline. Flank aligned with sides.

HAMS: Broad, wide deep to hock. Tail set high.

FLESH: Firm without excessive fat.

BONE AND HAIR: Fine. Skin free from coarseness and wrinkles.

LEGS: Short and set wide apart. The pig should stand well up on the tips of the toes.

This breed is used for bacon purposes by Denmark, Sweden, Russia, Poland, Lithuania, Estonia and other countries.

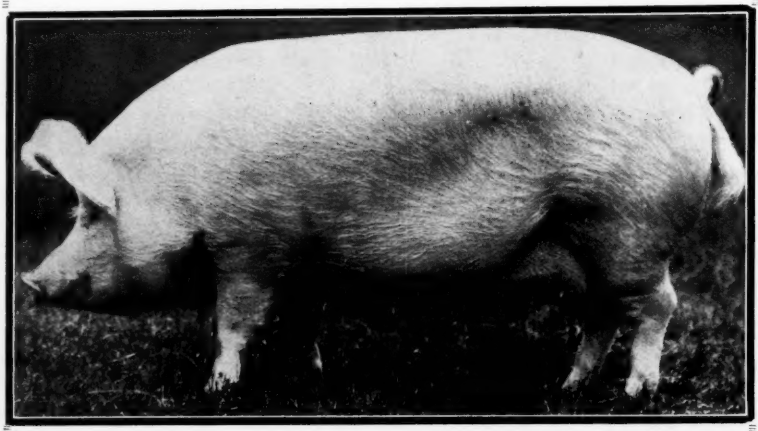


Photo by Sport & General

CHAMPION LARGE WHITE SOW

XUM

1406

THE BACON PIG.

By THE EARL OF RADNOR

Late Chairman of the Pig Industry Council; Member of the Pigs Marketing Board.

Classes.—The British Isles, which is the principal bacon-consuming country in the world, requires two distinct classes of bacon ; namely, the Wiltshire side-cut, which demands a pig of from 7 sc. to 8 sc. 10 lb. deadweight, and the Midland Trade, which will take pigs up to 11 sc. and over. The former is the more important because it comprises the bulk of the imported supplies, and the heavier type of bacon is a gradually diminishing demand. But apart from the question of weight the type of pig is the same in each case.

Requirements—The Commercial requirements of a bacon pig are the right weight, with a good length of side and a plump well-filled ham. The shoulder and head must be light, as the fore-end generally has to be sold cheaply, and the pig must be light in the bone. The back fat should be as even as possible over the whole length of the back, and the belly, or streak, should be as thick as possible. There must be no excessive fat.

Pig Production.—The production of such suitable pigs presents problems of feeding, breeding and management not as yet fully understood in this country. Looks are not the only criterion of whether a pig is suitable for breeding purposes or not. Performance on both the sire and dam's side must be taken into account, and careful records kept of the selected animal's own performance, comprising prolificacy, growth rate of the progeny, and their grading results. So far as breed is concerned, it is generally agreed that the most suitable sire is the Large White. A white pig is most desirable for bacon, as black pigs frequently suffer from pigmentation in the belly, known as "seedy cut." This so spoils the appearance of the bacon that it is not saleable. Strain within the breed is even more important than breed. The most suitable strains can only be found by careful records, and it is in this way that improvement through breeding is achieved.

But breeding is a comparatively simple problem to advise on compared with feeding and management : it is errors in these directions that so often cause loss through waste and disease. Correct feeding and management depend to a very great extent on the care and observation exercised by the man in charge of the pigs, always provided that the owner is prepared to realise that low-priced food is not necessarily the cheapest in the end. A properly-balanced ration is essential, and it includes such minerals as are necessary. A great many of the ills from which pigs suffer are brought on by faulty feeding. Slovenly management, such as irregularity in feeding, unnecessary dirt, and carelessness, must be avoided.

Disease.—Disease is the greatest difficulty that the pig keeper has to contend with. Visible losses from this cause are greater than they should be. But invisible losses are probably greater still, losses caused by unrecognised disease, the effects of faulty feeding or bad management. Knowledge of pig diseases in this country is woefully inadequate, due in the main to the fact that pigs have always been a secondary product, and not worth much trouble or expense. There are, however, several sources of serious loss, particularly in small pigs, on which there is little or no information available, nor have the causes apparently been discovered. It is not only that the pigs die, but, if checked when young, their rate of growth is liable to be affected and cause extra expense to the producer. The incidence of such diseases is very largely contributed to by the lack of knowledge on the part of the pig keepers, but when such diseases do appear no remedy is forthcoming. There are also serious losses through known diseases such as swine fever and swine erysipelas, which have in other countries been reduced to a minimum, largely by Government action in controlling the production of serums and vaccines used as preventives, and making them available at cost of production under a guarantee of purity and strength, a thing it should be possible to do in this country.

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A pocket-size folder entitled "Swine Erysipelas, Swine Fever—Differential Diagnosis" will be gladly forwarded upon request.

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